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Subj: HIGH SPEED VESSEL FINAL EXPERIMENTATION REPORT (FY02)

Encl: (1) High Speed Vessel (HSV) Final Experimentation
Report: Period of 18 October 2001-30 July 2002

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3000
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17 September 02

From: CSS Technology Project Officer
To: Commander, Marine Corps Warfighting Laboratory
Via: (1) Head, Technology Division
(2) Chief of Staff

Subj: **HIGH SPEED VESSEL (HSV) FINAL EXPERIMENTATION REPORT:
PERIOD OF 18 OCTOBER 2001 - 30 JULY 2002 (FY-02)**

Ref: (a) TACOM SOW, DAAE07-01-R-T100 of 20 June 2001
(b) JMOA of 10 Oct 2001

Encl: (1) CG MCCDC msg R 050930Z Nov 01
(2) Quick-Look Report: Joint High Speed Vessel of 15 November 01
(3) *Joint Venture (HSV-X1)* Limited Objective Experiment: Quick Look Report of 11 December 01
(4) Bulk Fuel Company, 2d Engineer Support Battalion LOE of 7 February 02
(5) Battle Griffin 02 Limited Objective Experiment of 10 April 02
(6) Experimental Embarkation Summary Statistics of 20 April 02
(7) Millennium Challenge 02 Limited Objective Experiment Analysis Report of 16 August 02

EXECUTIVE SUMMARY

1. Background

a. This project is a joint effort exploring commercially available High Speed Vessels (HSV) with advanced hull, propulsion, and communications technology to provide a surface craft with high-speed, long-range, and high-volume lift capabilities. During FY02 a series of Limited Objective Experiments (LOE), exercises, demonstrations, and training events have been conducted with the *Joint Venture (HSV-X1)* in order to assess the vessels capabilities and limitations. Data collected from these LOE's will support the concept development process and refine potential missions. The Marine Corps Combat Development Command (MCCDC), the Navy Warfare Development Command (NWDC), and the United States Army Combined Arms Support Command (CASCOM), in conjunction with commercial industry, are cooperating in this initiative.

b. The *Joint Venture (HSV-X1)* was designed in Australia by the shipbuilding company INCAT Tasmania Pty Ltd and leased from Bollinger/INCAT USA. Prior to delivery to the Department of Defense (DoD), the vessel underwent six (6) weeks of structural enhancements to install a certified flight deck to support SH-60/CH-46 helicopters, a starboard-aft quartering ramp to allow rapid loading/offloading of ground tactical vehicles, an overhanging crane system

to launch/recover small boats, and a robust Command, Control, Communications, Computers and Intelligence (C4I) suite.

c. The *Joint Venture (HSV-X1)* is a "surrogate technology" for the evaluation of capabilities, limitations and concepts for a future vessel of undetermined size and type.

2. Organization

a. Naval service. For all naval service experiments, NWDC is designated the "coordinating authority" for the duration of the lease. NWDC is working in close partnership with MCCDC to develop experimentation venues, define research objectives, and assess data.

b. Marine Corps

(1) The Commanding General, Marine Corps Combat Development Command (MCCDC), as Deputy Commandant for Combat Development (Designate), is the Marine Corps "lead" for HSV concept development and experimentation. Within MCCDC, the Expeditionary Force Development Center (EFDC) is coordinating all project planning and administration requirements for Marine Corps participation. Key support for the project has been provided by the Operating Forces, Headquarters Marine Corps and the Marine Corps Warfighting Laboratory. Forces and experiment venues have been provided by COMMARFORLANT, COMMAFORPAC and COMMARFOREUR.

3. **System Description.** The *Joint Venture (HSV-X1)* is a 96-meter, 45-knot, dual hull, shallow draft, commercial catamaran that has been modified to meet military experimentation requirements for rotary wing aircraft, roll-on/roll-off vehicles, small boats, and a state-of-the art command and control system.

4. **Concept.** Marine Corps experimentation efforts were designed to demonstrate the HSV's capabilities and limitations in scenarios that are operationally relevant to the concept of Expeditionary Maneuver Warfare (EMW). Efforts are focused to determine what impacts the HSV might have on future operational concepts throughout the deployment, employment, sustainment and redeployment cycle. Additionally, exploration into future HSV tactics, techniques, procedures, and technologies (TTPT) and the complementary nature of the vessel with Maritime Prepositioning Force (MPF), Amphibious Readiness Group (ARG) shipping, Marine Air Ground Task Force (MAGTF) Operations and its interoperability with fully networked, advance seabases will be conducted.

5. **Experiment Venues.** The following table lists all USMC experiments completed in FY02.

Table A. Experiment Venues

LOE	Venue	Location	Focus
1	Pierside Interoperability [18 Oct 01]	NAB Little Creek	Onload / Offload USMC ground tactical vehicles to assess compatibility with the HSV.

LOE	Venue	Location	Focus
1 (cont)	Lighterage Interoperability [25 Oct 01]	NAB Little Creek	Onload / Offload USMC ground tactical vehicles to evaluate accessibility to HSV via causeway sections (5x2 configuration) moored pierside. Causeway sections required attachment of a specialized fendering system to prevent metal-to-metal contact with the HSV and possible hull punctures (see Figure 3 photo).
2	MPF Interoperability (onload): [28 Nov 01] MPF Interoperability (transit & offload) [29 Nov 01]	Morehead City, NC (MHC) Blount Island Cmd (BIC)	Eight (8) AAV's from the <i>MV Pless</i> were offloaded (in-stream) and loaded aboard the HSV (pierside) for follow-on transport to BIC. HSV executed an <u><i>intra-theater transit</i></u> from MHC to BIC. HSV moored adjacent to a confined and restrictive "austere" pier and offloaded (8) AAV's.
3	Intra-Theater Lift: -Exercise Winter Blaze [10 Jan 02]	Morehead City, NC - NAB Little Creek, VA	Loaded breakbulk cargo and personnel (Bulk Fuel Co., 2d FSSG) at MHC for intra-theater transport to NABLC for offload.
4	Intra-Theater Lift: [5 Feb 02] Inter / Intra-Theater Lift: EUCOM / NALMEB Battle Griffin 02 [5 Feb 02 - 7 Mar 02] NATO Combined Force Exercise - II MEF Exercise: Battle Griffin 02 [7-17 Mar 02]	NAB Little Creek, VA - Morehead City, NC Morehead City, NC - Trondheim, Norway Trondheim, Norway	Loaded breakbulk cargo and personnel (Bulk Fuel Co., 2d FSSG) at NABLC for <u><i>intra-theater</i></u> transport to MHC for offload. Following offload of Bulk Fuel Co. in MHC, began onload of (11) M198 Howitzers (from BIC) for <u><i>inter-theater</i></u> transport to NALMEB facility, Norway. Assessed M198 compatibility and maneuverability aboard the HSV and subsequent offload in Trondheim. HSV provided mission support to MAGTF operations: -reinforcement -sustainment -deception -envelopment
5	Small Boat Interoperability JFCOM Joint Exercise Millennium Challenge 02 [21-22 Jul 02] Helicopter Interoperability JFCOM Joint Exercise Millennium Challenge 02 [27 Jul 02] MAGTF Anti-Access / STOM: JFCOM Joint Exercise Millennium Challenge 02 [28-30 Aug 02]	Naval Station San Diego & vicinity Del Mar Boat Basin, CamPen Vicinity Del Mar Boat Basin, CamPen Del Mar Boat Basin, CamPen	Launched and recovered (day) USMC Combat Rubber Reconnaissance Craft (CRRC) with Marine Recon Teams (pierside / at-sea) USMC CH46E performed (15) take-offs and landings (at-sea) during Deck Landing Qualifications (DLQ). HSV moored adjacent to a Floating Causeway Pier in support of MAGTF operations: -R&S insert -STOM Reinforcement -STOM Sustainment -Humanitarian Evac (NEO)

6. **Objectives.** Table B lists all objectives assessed during USMC LOE's in FY02.

Table B. USMC Assessment Objectives

Objective	Issue	Target
Operational Maneuver	A. HSV Interoperability-Compatibility with: 1. Rotary aircraft 2. Ground vehicles 3. Cargo 4. Ports 5. Bi-Lateral Equipment 6. Small boats (USMC) 7. Floating Causeway Pier	1. CH-46, SH-60 2. see Table 6 3. Containerized and bulk cargo 4. Commercial and Military (austere, degraded) 5. Norway ground tactical/logistics vehicles 6. Combat Rubber Reconnaissance Craft (CRRC) 7. 9 x 2 (CSNP's) x 1 (CSNP-BE) configuration (see enclosure 7)
	B. HSV operational performance 1. Draft 2. Range 3. Speed 4. Max Payload 5. Fuel economy 6. Maneuverability 7. Mission Performance in Sea State-3	1. 13-15 feet @ max payload 2. 600 NM @ 35 knots with max payload 3. 38 knots with max payload 4. 545 short tons 5. 20% fuel remaining after 600 NM at 35 knots with max load 6. Confined and restrictive waterway 7. Small boat (CRRC) launch & recovery with USMC Recon teams
	C. Assess Command & Control 1. Operational control	1. MAGTF / ARG / MPF Operations
Human Factors	A. Assess shipboard "Human Factor" support for embarked personnel.	This objective focused on the effects high-speed transit has on embarked personnel in regard to: -mission readiness -safety -health -habitability Assessments also focused on the support systems the vessel provided for embarked personnel.

7. **Conclusion.** The HSV has successfully demonstrated the capability to provide greater operational mobility, theater logistics support, and additional force closure options in the conduct of EMW. Continued experimentation with HSV technology in FY03 would provide significant evaluation of the vessels interoperability with Marine Air Ground Task Force (MAGTF) Operations, Amphibious Readiness Group (ARG) shipping, the Maritime Prepositioning Force (MPF) and other enhanced networked seabase platforms.

FINAL REPORT

1. Background

a. This project is a joint effort exploring commercially available High Speed Vessels (HSV) with advanced hull, propulsion, and communications technology to provide a surface craft with high-speed, long-range, and high-volume lift capabilities. These rapidly adaptive characteristics have created an opportunity to develop transformational concepts that can significantly enhance Expeditionary Maneuver Warfare (EMW). A series of limited objective experiments, exercises, demonstrations, and training events have been conducted with the *Joint Venture (HSV-X1)* in order to assess the vessels capabilities and limitations. The evaluation of data collected from these LOE's will be used to support the concept development process, and refine potential missions utilizing Network Centric principles and existing Navy-Marine Corps operational capabilities. The Marine Corps Combat Development Command (MCCDC), the Navy Warfare Development Command (NWDC), and the United States Army Combined Arms Support Command (CASCOM), in conjunction with commercial industry, are cooperating in this initiative to explore the operational implications of this state-of-the art technology.

b. The *Joint Venture (HSV-X1)* was designed in Australia by the shipbuilding company INCAT Tasmania Pty Ltd and leased from Bollinger/INCAT USA. Prior to delivery to the Department of Defense (DoD), the vessel underwent six (6) weeks of structural enhancements to install a certified flight deck to support SH-60/CH-46 helicopters, a starboard-aft quartering ramp to allow rapid loading/offloading of ground tactical vehicles, an overhanging crane system to launch/recover small boats, and a robust Command, Control, Communications, Computers and Intelligence (C4I) suite. Habitability modifications were also made to accommodate "quality of life" issues associated with the embarkation and transportation of troops over extended high-speed transits.

c. The *Joint Venture (HSV-X1)* is a "surrogate technology" for the evaluation of capabilities, limitations and concepts for a future vessel of undetermined size and type.

2. Organization for Experimentation

a. Naval service. For all naval service experiments, NWDC is designated the "coordinating authority" regarding HSV usage and support for the duration of the lease. NWDC is working in close partnership with MCCDC to develop experimentation venues, define research objectives, and assess collected data.

b. Marine Corps

(1) The Commanding General, Marine Corps Combat Development Command (MCCDC), as Deputy Commandant for Combat Development (Designate), is the Marine Corps "lead" for HSV concept development and experimentation. Within MCCDC, the Expeditionary Force Development Center (EFDC) is coordinating all project planning and administration requirements for Marine Corps participation. Key support for the project has been provided by the Operating Forces, Headquarters Marine Corps (HQMC) and the Marine Corps Warfighting

Laboratory (MCWL). Forces and experiment venues have been provided by COMMARFORLANT, COMMAFORPAC and COMMARFOREUR.

(2) From 18 October 2001 through 30 July 2002, the experimentation team from MCCDC and the Marine Corps Warfighting Lab (MCWL) have planned and executed five (5) Marine Corps oriented LOE's with the HSV. The primary focus of each LOE was to assess the "military utility" of the HSV within the context of EMW, to include intra-theater support and littoral mobility. These experiments collected data and observations concerning the vessel's operational performance with various shipping (amphibious and MPF), lighterage, embarked personnel (military, civilian), ground tactical/logistics vehicles, small boats, rotary aircraft, containers and break bulk cargo.

c. Key USMC Participants. The following personnel designed, coordinated and executed all Marine Corps LOE's:

- (1) Major Larry Ryder (MCCDC-JCDE) - HSV Project Manager
- (2) Major Mark Johnson (MCCDC-JOC) - Program Support
- (3) Major Jim Stone (MCWL) - Experiment Design and Assessment
- (4) Captain Michele Kane (MCWL) - Experiment Design and Assessment
- (5) Randy Bickel (MCWL) - Experiment Design/Data Collection
- (6) John Goetke (MCWL/CNA) - Analyst/Data Collection

3. System Description

a. Definition. The *Joint Venture (HSV-X1)* is a 96-meter, 45-knot, dual-hull, shallow-draft commercial catamaran that has been modified with a certified flight deck (SH-60, CH-46), starboard-aft quartering ramp, an overhanging crane system (launch/recover small boats), and a robust C4I suite.

b. Capabilities. Table 1 provides key HSV performance characteristics.

Table 1. Key Performance Capabilities

Item	Capability
Maximum Speed	35 knots with max payload 48 knots with no payload
Maximum Draft	13-15 feet with max payload
Maximum Range	- 600 NM @ 35 knots with max payload -2400 NM @ 35 knots with no payload
Maximum Payload (tonnage)	545 Short Tons (max embarked cargo)
Maximum Payload (area)	23,000 SqFt (max embarked cargo)
Maximum Vehicle Weight (Starboard-Aft Quartering Ramp)	70,000 lbs (35 Short tons)
Embarked PAX	240 personnel (max male & female)
Crew (max)	45 personnel (male & female)

Item	Capability
Berthing	45 crew berths / 48 surge berths
Flight Deck Certification	SH-60, CH-46
Vessel Deadweight	815 Short Tons
Vessel Length	96-meters (314 feet)
Vessel Beam	26-meters (87 feet)
Engines	4-Caterpillar Marine Diesels

c. **Limitations.** For the purpose of experimentation, the term "limitation" refers to any circumstance that prevents the assessment of objectives or the collection of required data. Table 2 lists all limitations in effect for HSV experiments.

Table 2. System Limitations

Item	Limitation
Sea-State	Sea State-1 is the maximum condition allowed for in-stream RO/RO and LO/LO (bulk cargo).
Maximum Loadout	LOE's to date have not had enough assets available to achieve the HSV's maximum payload weight or square-footage.
Sea Ice	The HSV cannot operate in areas where sea ice is a risk.
AAV Launch/Recovery	In-stream launch/recovery of Assault Amphibian Vehicles (AAV) is not available.
Starboard-Aft Quartering Ramp	Ramp strength is limited to 35 short tons (70,000 lbs) therefore the M1A1 Main Battle Tank is incompatible with the <i>Joint Venture (HSV-X1)</i> .
In-Stream Onload/Offload	These operations are restricted to the hours of daylight.
Flight Deck Operations	Flight deck operations are restricted to day "VFR" only.
Shipboard Habitability	Shipboard accommodations, habitability and outfitting will be "ruggedized and simplified" for all LOE's and not in accordance with the Naval Sea Systems Command (NAVSEA) "Shipboard Habitability Design Criteria Manual". Therefore, experimentation did not assess the suitability of existing accommodations but will provide recommendations regarding the unique "human factor" requirements for high-speed vessels in general.
ISO/TEU Containers	The configuration and weight limit of the starboard-aft quartering ramp does not support Container Handling Equipment (i.e. RTCH, CALMAR). Therefore, during experimentation ISO/TEU containers were not utilized. Note: ISO/TEU containers <u>are</u> accessible to the <i>Joint Venture</i> if non-standard loading practices are employed.
Blackout Conditions	The capability to "blackout" white lights during tactical night operations has not been installed.
'Forward' Mezzanine Ramps and Decks	These areas were excluded from all LOE's due to low clearances. The only vehicles that can transit these areas are the IFAV and M998 HMMWV (low-back). Due to this low clearance (about 1-inch above vehicle top) damage may result to vehicles staged in these locations during at-sea transits. The vertical motion generated during high speed transits "bounces" vehicles into contact with the overhead.

Item	Limitation
'Centerline' Mezzanine Deck (Hoistable)	<p>The hoistable "overhead" Mezzanine Deck has multiple limiting factors, to include:</p> <ul style="list-style-type: none"> -The area does not have the required deck strength to support ground tactical vehicles. Therefore it was excluded from all experiments. -From the Main Vehicle Deck the 'Centerline' Mezzanine Deck creates an "overhead" obstacle to the transit of an LVS (Mk48/14) with a mobile loaded ISO container. The 'Centerline' Mezzanine Deck is 13' 3" above the Main Vehicle Deck. The LVS (Mk48/14) with mobile loaded ISO container has a vertical height of 13' 4". Therefore the LVS (MK48/14) with mobile loaded ISO container cannot transit beneath this area.

4. Marine Corps Experimentation

a. Concept. Marine Corps experimentation efforts were designed to demonstrate the HSV's capabilities and limitations in scenarios that are operationally relevant to the concept of Expeditionary Maneuver Warfare (EMW). Efforts were focused to determine what impacts the HSV might have on future operational concepts throughout the force deployment, employment, sustainment and redeployment cycle. Additionally, exploration into future HSV tactics, techniques, procedures, and technologies (TTPT) and the complementary nature of the vessel with Maritime Prepositioning Force (MPF) and Amphibious Readiness Group (ARG) shipping were conducted.

b. Venues. Table 3 identifies all USMC oriented LOE's completed during FY02:

Table 3. Venues

LOE	Venue	Location	Focus
1	Pierside Interoperability [18 Oct 01]	NAB Little Creek	Onload / Offload USMC ground tactical vehicles to assess compatibility with the HSV.
	Lighterage Interoperability [25 Oct 01]	NAB Little Creek	Onload / Offload USMC ground tactical vehicles to evaluate accessibility to HSV via causeway sections (5x2 configuration) moored pierside. Causeway sections required attachment of a specialized fendering system to prevent metal-to-metal contact with the HSV and possible hull punctures (see Figure 3 photo).
2	MPF Interoperability (onload): [28 Nov 01]	Morehead City, NC (MHC)	Eight (8) AAV's from the <i>MV Pless</i> were offloaded (in-stream) and loaded aboard the HSV (pierside) for follow-on transport to BIC.
	MPF Interoperability (transit & offload) [29 Nov 01]	Blount Island C (BIC)	HSV executed an <i>intra-theater transit</i> from MHC to BIC. HSV moored adjacent to a confined and restrictive "austere" pier and offloaded (8) AAV's.
3	Intra-Theater Lift: -Exercise Winter Blaze [10 Jan 02]	Morehead City, NC - NAB Little Creek, VA	Loaded breakbulk cargo and personnel (Bulk Fuel Co., 2d FSSG) at MHC for intra-theater transport to NABLC for offload.

LOE	Venue	Location	Focus
4	Intra-Theater Lift: [5 Feb 02]	NAB Little Creek, VA - Morehead City, NC	Loaded breakbulk cargo and personnel (Bulk Fuel Co., 2d FSSG) at NABLC for <i>intra-theater</i> transport (return) to MHC for offload.
	Inter / Intra-Theater Lift: EUCOM / NALMEB Battle Griffin 02 [5 Feb 02 - 7 Mar 02]	Morehead City, NC - Trondheim, Norway	Following offload of Bulk Fuel Co. in MHC, began onload of (11) M198 Howitzers (from BIC) for <i>inter-theater</i> transport to NALMEB facility, Norway. Assessed M198 compatibility and maneuverability aboard the HSV and subsequent offload in Trondheim.
	NATO Combined Force Exercise - II MEF Exercise: Battle Griffin 02 [7-17 Mar 02]	Trondheim, Norway	HSV provided mission support to MAGTF operations: -reinforcement -sustainment -deception -envelopment
5	Small Boat Interoperability JFCOM Joint Exercise Millennium Challenge 02 [21-22 Jul 02]	Naval Station San Diego & vicinity Del Mar Boat Basin, CamPen	Launched and recovered (day) USMC Combat Rubber Reconnaissance Craft (CRRC) with Marine Recon Teams (pierside / at-sea)
	Helicopter Interoperability JFCOM Joint Exercise Millennium Challenge 02 [27 Jul 02]	Vicinity Del Mar Boat Basin, CamPen	USMC CH46E performed (15) take-offs and landings (at-sea) during Deck Landing Qualifications (DLQ).
	MAGTF Anti-Access / STOM: JFCOM Joint Exercise Millennium Challenge 02 [28-30 Aug 02]	Del Mar Boat Basin, CamPen	HSV moored adjacent to a Floating Causeway Pier in support of MAGTF operations: -R&S insert -STOM Reinforcement -STOM Sustainment -Humanitarian Evac (NEO)

c. Assessment Objectives. USMC oriented LOE's identified vessel capabilities and limitations for operational employment. Each LOE evaluated the vessel in environments that were as operationally realistic as possible and were conducted utilizing typical Marine and Navy personnel to obtain a valid estimate of user and equipment interfaces. The objectives listed in Table 4 were assessed during USMC experimentation with the *Joint Venture (HSV-X1)*.

Table 4. USMC Assessment Objectives

Objective	Issue	Target
Operational Maneuver A. Assess HSV Performance regarding:	1. Mobility: a. Draft b. Range c. Speed d. Payload e. Fuel f. Maneuverability	a. 13 feet @ max payload b. 600 NM @ 35 knots @ max payload c. 38 knots @ max payload d. 545 short tons e. 20% after 600 NM @ 35 knots, max payload f. Confined / restrictive waterway (channel)

Objective	Issue	Target
A. HSV Performance (<i>cont.</i>): B. Assess HSV Interoperability/ Compatibility regarding: C. Assess Command & Control regarding:	2. Self-Supportability: 1. USN/USMC assets: a. Rotary wing aircraft b. Ground vehicles c. Cargo d. Ports e. Lighterage f. Piers g. Shipping h. Bi-Lateral equipment i. USMC small boats 1. Operational control:	a. Self-Deploying b. Self-Mooring c. Self-Sustaining offload d. Simultaneous offload a. SH-60, USN CH-46, USMC CH46E b. USMC variants (See Table 6) c. Containerized and bulk cargo d. Commercial, Military, Austere, degraded e. Causeways (powered & non-powered) f. Floating Causeway Pier g. MPF, ARG h. Norway ground tactical vehicles i. CRRC's a. MAGTF operations b. ARG operations c. MPF operations
Durability A. Assess HSV survivability regarding:	1. Operational Support 2. Extreme Weather	a. MAGTF mission tasks b. ARG mission tasks c. MPF mission tasks a. Sea States 3-5 (Pierson-Moskowitz) b. Arctic conditions (Norway)
Habitability A. Assess Human Factor issues:	1. Safety 2. Health 3. Facilities	a. Fire prevention / detection b. Firefighting equipment c. Safety measures during embark/debark d. HAZMAT and fuel storage e. Personal Protective Equipment (PPE) a. Sanitation (all embarked spaces) b. First Aid / Medical support a. Berthing b. Heads (toilets) c. Seating area d. Recreation area e. Work spaces f. Environment (temperature, ventilation)

d. Summary of Key Events. Throughout FY02, experimentation with the *Joint Venture (HSV-X1)* in support of MPF, ARG, and MAGTF missions demonstrated various operational capabilities and performance characteristics. Table 5 (below) is a "general" summary of those events that were considered to be "significant" in evaluating the vessels potential to augment intra-theater support and littoral mobility. A detailed review of all observations and data collected in LOE's 1-5 can be found in the enclosures to this report.

Table 5. Summary of Key Events



Event	Performance Data	Capabilities Demonstrated
<u>LOE 1: Vehicle / Lighterage Interoperability and Compatibility</u>	<i>[See Table 6 below]</i>	
<u>LOE 2: MV Pless Offload</u> HSV embarked eight (8) AAV's from the <i>Pless</i> at MHC for transport to BIC. Focus of this event was high-speed transit from a commercial port, maneuvering into and mooring adjacent to an "austere" port and then executing a timely offload.	USMC personnel: 12 Draft (max payload): 13.2 feet Payload (short tons): 190 Transit distance: 375 NM Max speed attained: 39 kts Sustained speed: 31 kts AAV load time: 27 min/13 sec AAV offload time: 16 min/14 sec <i>Note: Only (4) crews to offload (8) AAV's, increased offload time</i>	1. High-Speed intra-theater transit 2. Austere port offload (BIC) 3. Interoperability-degraded port (BIC) 4. Interoperability-military port (NAS Mayport, FL) 5. Interoperability-commercial port (MHC) 6. MPF mission support <i>Note: Due to logistical constraints, HSV forced to use BIC fenders which redesignated the port as "degraded" vice "austere". However, subject-matter-experts evaluated the BIC event as an <u>exceptional</u> demonstration of a tactical offload into an "austere" maritime environment. The maneuverability of the HSV into a confined berth, restricted by concrete abutments, pierside obstructions and other ships was an outstanding display of maneuverability and flexibility.</i>
<u>LOE 3: Bulk Fuel Co. Lift</u> HSV transported unit assets from MHC to NABLC.	USMC personnel: 159 Breakbulk cargo: 96 items Tactical vehicles: 9 Payload (short tons): 240 Load time: 7 hrs/20 min Offload time: 2 hrs/37 min	1. Intra-theater transit 2. Interoperability - military port 3. Interoperability - commercial port 4. MAGTF logistic mission
<u>LOE 4: Battle Griffin '02</u> <div> <div>Phase 1:</div> <div> Transported eleven (11) M198 Howitzers from MHC to Larvik, Norway. <i>Note: Howitzers were exchanged between BIC and NALMEB on a scheduled maintenance cycle.</i> </div> </div>	<div> <div>Phase 1:</div> <div> Tactical equipment: 11 Payload (short tons): 92 Load time (stage/lash): 2 hr/15 min Offload time: 1 hr/40 min </div> </div>	<div> <div>Phase 1:</div> <div> 1. Inter-theater transit (TransLant) 2. MPF (NALMEB) mission 3. Interoperability - commercial port </div> </div>










Event	Performance Data	Capabilities Demonstrated
<u>LOE 4: Battle Griffin '02</u>		
Phase 4:	Phase 4:	Phase 4:
Deployed (82) MAGTF personnel, (26) LAV, and (6) HMMWV from the <i>USS Tortuga</i> (LSD-46) in-port Larvik and transported to Hommelvik, Norway.	MAGTF Personnel: 82 Tactical vehicles: 32 Payload (short tons): 395 Load time: unk Offload time: 25 min	1. Intra-theater transit 2. Interoperability - commercial port 3. ARG logistic mission 4. MAGTF logistic mission
Phase 5:	Phase 5:	Phase 5:
<i>Event A</i> ~~~~~	<i>Event A</i> ~~~~~	<i>Event A</i> ~~~~~
Executed an envelopment from-the-sea to reinforce MAGTF forces ashore with (5) LAV, (15) HMMWV, and (4) BV-206 tracked vehicles.	MAGTF Personnel: 108 Tactical vehicles: 24 Payload (short tons): 138 HSV moored-ramp down: 1 min Offload 25 vehicles: 11 min Offload 108 Marines: 2 min HSV ramp-up/underway: 2 min	1. MAGTF tactical mission 2. MAGTF logistic mission 3. Bi-Lateral logistic mission 4. Intra-theater transit 5. Interoperability - austere port 6. Interoperability - commercial port
<i>Event B</i> ~~~~~	<i>Event B</i> ~~~~~	<i>Event B</i> ~~~~~
Redeployed (20) BV-206 tracked vehicles (Norwegian) from Orkanger to Hommelvik.	MAGTF personnel: 172 Payload (short tons): 138 Load time: 10 min	1. Intra-theater transit 2. Interoperability - commercial port 3. Bi-Lateral mission
<i>Event C</i> ~~~~~	<i>Event C</i> ~~~~~	<i>Event C</i> ~~~~~
Redeployed MAGTF personnel, (26) LAV, and (6) HMMWV from Hommelvik to <i>USS Tortuga</i> (LSD-46) in-port Larvik, Norway.	MAGTF personnel: 106 Payload (short tons): 395 Load time: 2 hr / 30 min Offload time: 22 min	1. Intra-theater transit 2. Interoperability - commercial port 3. ARG logistic mission 4. MAGTF logistic mission
<u>LOE 4: Millennium Challenge '02</u>		
Phase 1:	Phase 1:	Phase 1:
CH46E (USMC) executed (15) take-offs and landings (DLQ's) aboard the HSV in vicinity Del Mar, CPCA. <i>Note: First demonstration of USMC CH46E compatibility.</i>	DLQ Take-offs / landings: 15	At-sea interoperability USMC CH46E









Event	Performance Data	Capabilities Demonstrated
<p><u>Phase 2:</u></p> <p>Executed a R&S insert (night) with a USMC Recon force of (22) Marines via (4) CRRC's from the HSV in support of STOM operations ashore.</p>	<p><u>Phase 2:</u></p> <p>MAGTF personnel: 21 CRRC avg launch time: 1min 40 sec Recon pers avg load time: 95 sec Recon pers avg offload time: 30 sec CRRC avg recovery time: 2 min</p>	<p><u>Phase 2:</u></p> <p>1. MAGTF R&S insert capable (day/night) 2. CRRC compatibility 3. Intra-theater transit</p>
<p><u>Phase 3:</u></p> <p><i>Event A</i> ~~~~~</p> <p>HSV executed a reinforcement and sustainment mission with (9) tactical vehicles over a Floating Causeway Pier in the Del Mar Boat Basin.</p> <p><i>Event B</i> ~~~~~</p> <p>HSV executed a Humanitarian Evacuation of non-combatants (NEO) over a Floating Causeway Pier.</p>	<p><u>Phase 3:</u></p> <p><i>Event A</i> ~~~~~</p> <p>MAGTF personnel: 21 LAV-AT: 2 LAV-L: 2 LVS (Mk48/14): 3 M813 Truck: 2 Ramp down 1st veh off: 1 min 40sec Ramp down last veh off: 4 min 40sec</p> <p><i>Event B</i> ~~~~~</p> <p>Non-combatant personnel: 13 Non-combatant load time: 7min Non-combatants abd, ramp up: 20 sec HSV underway: 2 min</p>	<p><u>Phase 3:</u></p> <p><i>Event A</i> ~~~~~</p> <p>1. MAGTF tactical mission support 2. MAGTF logistic mission support 3. Intra-theater transit 4. Interoperability - ground tactical vehicles 5. Interoperability - floating causeway pier</p> <p><i>Event B</i> ~~~~~</p> <p>1. Humanitarian operations capable 2. Intra-theater transit 3. Interoperability - floating causeway pier</p>



e. Vehicle / Lighterage Interoperability & Compatibility. Table 6 identifies those vehicles evaluated on their ability to embark aboard the HSV, maneuver through the Main Vehicle Deck by navigating all turns, and avoiding obstructions.






Table 6. Vehicle / Lighterage Interoperability & Compatibility

Vehicle Type	Photo	Assessment	Comments
<p>CH46E (USMC) - delivers PAX to HSV during (15) take-off & landings.</p> <p>SH60 (Navy) - Delivers PAX to HSV during high-speed transit</p>		<p>SAT</p>	<p>USMC CH46E aboard HSV</p> 

Vehicle Type	Photo	Assessment	Comments
Interoperability: HSV moored & offloading to a Floating Causeway Pier		SAT	HSV successfully moored adjacent to a modified "floating causeway pier" in the Del Mar boat basin, CPCA (9 x 2 x 1 CSNP configuration). The CSNP's were modified with a specialized fendering system to prevent metal-to-metal contact (see figure 3).
Interoperability: HSV & Pierside Causeway Sections		SAT	HSV successfully moored adjacent to modified "causeway sections" (5x2 CSNP configuration). The CSNP's were moored to a standard pier and were modified with a specialized fendering system to prevent metal-to-metal contact. Continued experimentation is recommended to verify the full range of this capability.
CRRC (USMC)	 	SAT	1. HSV successfully launched & recovered CRRC's with USMC Recon teams at-sea (day only) 2. HSV successfully launched CRRC's at-sea with USMC Recon teams (day & night)
AAV (LVT-P7A1)		SAT	AAV pivoting action causes damage to the protruding "tie-down padeyes."  
M923		SAT	
M998 HMMWV (Low-Back)		SAT	Due to height restrictions the only embarked vehicles to safely <u>maneuver</u> through the Mezzanine Ramps and Decks were the IFAV and M998 HMMWV (low-back configuration). However, during at-sea transits these vehicles would have been damaged as they recoiled against the overhead. These vehicles only have 1-inch clearance between vehicle roof and overhead.

Vehicle Type	Photo	Assessment	Comments
M149 Water Trailer		SAT	
IFAV	 	SAT	Due to height restrictions the only embarked vehicles to safely <u>maneuver</u> through the Mezzanine Ramps and Decks were the IFAV and M998 HMMWV (low-back configuration). However, during at-sea transits these vehicles would have been damaged as they bounced against the overhead. These vehicles only have 1-inch clearance between vehicle roof and overhead.
Breakbulk Cargo (pallets, boxes, quad-cons)		SAT	Break Bulk Items - 96 Breakbulk weight - 210 Short Tons Very slow to load/offload. Items need to be pre-packed in a container system to maximum extent possible to reduce load times.
M998 HMMWV (High-Back)		SAT	
M915 Truck w/ M872 Flatbed Trailer		UNSAT	>M915 lost traction transiting knuckle on Ramp >M872 tool bin failed to clear Ramp knuckle 
MHE (EBFL)		SAT	
MHE (RT-4000)		SAT	

Vehicle Type	Photo	Assessment	Comments
MHE (TRAM)		SAT	
MHE (6K Fork)	<i>No Photo Available</i>	SAT	Ship's organic MHE
M936 Wrecker		SAT	5-Ton variant
M923 Truck w/Welding Trlr		SAT	The M923 w/welding trailer could not complete transit through the Main Vehicle Deck due to an "administrative" obstruction.
LAV Variants		SAT	All listed variants were compatible / interoperable: -LAV-25 -LAV-AT -LAV-L
M998 HMMWV (Hi-back) w / M116 trailer		SAT	
M929 Dump Truck w/M353 trailer		SAT	
LVS (Mk48/14) with mobile-loaded ISO container		SAT	The 'Centerline' Mezzanine Deck is an 'overhead' obstacle to an LVS with a mobile loaded ISO container. The Mezzanine Deck is 13' 3" above the Main Vehicle Deck while the LVS (Mk48/14) with ISO container 13' 4" .
M927 Long Bed		SAT	M927 Long Bed w/trailer requires a 3-point turn to transit forward area of main vehicle deck
M198 Howitzer		SAT	M198's were embarked using RT-4000 Forklifts. Maneuverability was greatly enhanced by "pushing" M198's aboard with the RT-4000 vice pulling.

Vehicle Type	Photo	Assessment	Comments
BV-206		SAT	Norwegian Army Logistics Tracked Vehicle
LVS (Mk48/16/870)		UNSAT	<p>>The M870 trailer has three rows of parallel rear axles. As the trailer transited the "dips and knuckles" of the ramp, the two "inboard" axles of the trailer lost contact with the ramp. If the trailer had been transporting heavy cargo, the entire weight of that cargo would have been supported by a <u>single</u> axle vice three. It is foreseeable that damage could have resulted if the axle's capacity was exceeded by the cargo. Had the ramp been completely straight this particular problem would not be an issue.</p>   <p>>The loading of this LVS configuration was only possible by backing the trailer aboard. Though the entire vehicle was "physically" loaded aboard the HSV it had to be staged athwartship creating an obstruction to selective offloading and normal operating routines in the aft are of the ship.</p>
Light Tactical Vehicle		SAT	Norwegian Mercedes (Light Tactical Vehicle)
M1046 HMMWV (TOW variant)		SAT	
M1043 HMMWV (HMG variant)		SAT	
M1097 HMMWV (Avenger-Air Defense)		SAT	

5. Conclusions

a. Successful Events. Throughout FY02 experimentation, quantitative and qualitative data was collected. All subsequent conclusions regarding "military utility" are based on the "collaborative" analysis of all data by Subject Matter Experts (SME) and MCWL analysts. The following conclusions were derived from data collected during LOE's 1-5 (see Table 1) regarding "specific" performance characteristics observed during events in support of the Marine Corps concept of employment. With regard to the vessels limitations (see Table 2), the *Joint Venture (HSV-X1)* successfully demonstrated the following capabilities:

- (1) High-speed Intra-theater lift (per experiment venue in enclosures (3, 4, 5, 6, 7))
- (2) High-speed Inter-theater lift (per experiment venue in enclosure (5, 6))
- (3) The HSV was compatible and interoperable with:

(a) During the five LOE's in FY02, 27 USMC ground equipment items, one USMC helicopter variant and a small reconnaissance boat (CRRC) were evaluated for interoperability & compatibility with the HSV. The CH46E, the CRRC and 25 of the 27 ground equipment items (Table 6) were assessed as compatible with the *Joint Venture (HSV-X1)*. The two "non-compatible" items were trailer units that could not transit the starboard aft quartering ramp or maneuver through the turns on the main vehicle deck.

- (b) breakbulk cargo (pallets, quad-cans, outsized boxes, hose reels, etc,)
- (c) CH46E helicopter
- (d) CRRC's (USMC)
- (e) military, commercial ports
- (f) austere, degraded ports
- (g) causeway sections, non-powered (CSNP) moored pierside
- (h) floating causeway pier (CSNP, CSNP-BE), modified (Figure 1)

Figure 1. HSV moored to Floating Causeway Pier



- (4) MAGTF 'tactical' mission (per experiment venue in enclosure (5, 6))
- (5) MAGTF 'logistic' mission (per experiment venue in enclosures (4, 5, 6))
- (6) MAGTF humanitarian mission (per experiment venue in enclosure (7))

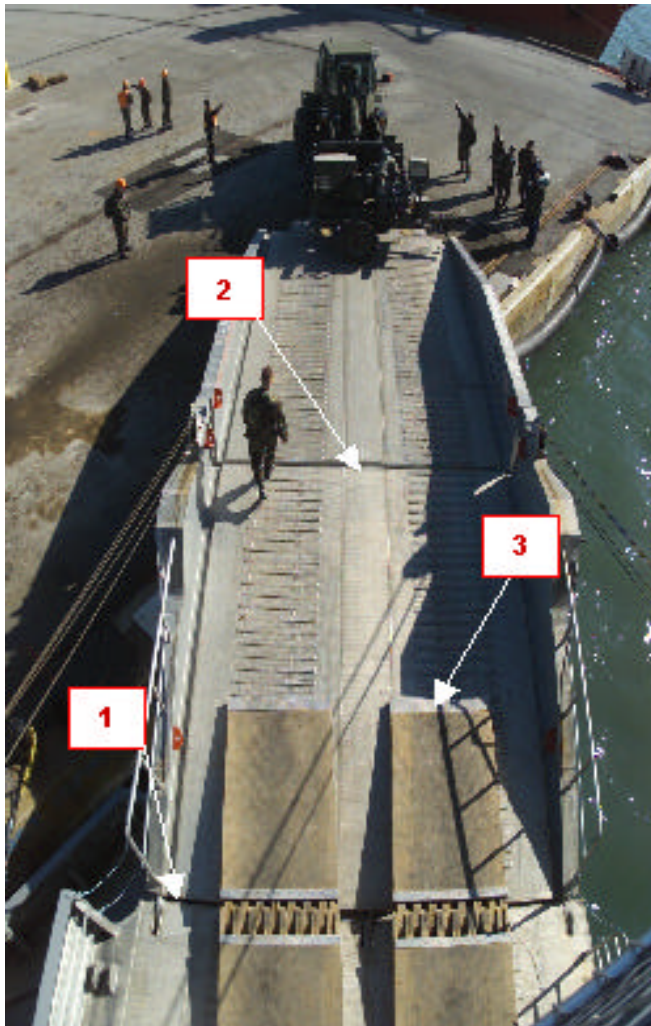
- (7) MPF/NALMEB mission (per experiment venue in enclosures (2, 3))
 - (8) ARG mission (per experiment venue in enclosure (5, 6))
 - (9) Self-supportability at (3) Norwegian degraded ports:
 - (a) the HSV's "rub rail" was sufficient fendering at these Norwegian ports.
 - (b) ports were re-classified as 'degraded' vice 'austere' due to presence of a pierside fender system along the pier
 - (10) Highly maneuverable in restricted and confined waters (see enclosure (7)).
- b. Within the concept of the force deployment, employment, sustainment, and redeployment cycle the HSV successfully demonstrated the following capabilities:
- (1) Deployment:
 - (a) strategic and tactical deployment of assets
 - (b) enabled MAGTF port-to-port assembly in conjunction with ARG shipping
 - (c) supported ship-to-port reorganization of available shiploads
 - (d) demonstrated trans-shipment of MPF equipment from a Forward Operating Base (FOB) to a MAGTF Area-of-Operations (AO)
 - (2) Employment:
 - (a) provided flexibility in the delivery of critical logistics support
 - (b) enabled tactical maneuver and flexibility as high-speed lighterage
 - (c) enabled tactical maneuver and flexibility as "raid insertion" vessel
 - (d) demonstrated operational and tactical supportability by maneuvering in confined and restrictive waterways
 - (e) demonstrated tactical maneuver, flexibility and survivability in sea state-3
 - (3) Sustainment:
 - (a) provided rapid resupply to forces ashore
 - (b) increased tactical flexibility (operational maneuver) by using waterways to bypass congested and vulnerable overland MSR's
 - (c) increased tactical flexibility (operational maneuver) by demonstrating interoperability with rotary wing aircraft
 - (d) accessed degraded ports to deliver forces and support
 - (4) Redeployment:
 - (a) provides quick redeployment of forces and support for subsequent use
- c. Deficiencies. With regard to the vessels limitations (see Table 2), the following deficiencies were identified during USMC oriented experiments:
- (1) When making high-speed approaches/turns into offload points the HSV creates

large wakes and swells that could be a concern for smaller support craft (patrol boats, zodiacs, RHIB's, etc.) operating in the vicinity.

(2) The starboard-aft quartering ramp design creates onload-offload difficulties:

(a) when the ramp is deployed during low to mid-range tides, two "dips" or "knuckles" are created at the ramp joints (see Figure 2 below), causing vehicles/trailers with low clearances to "bottom out", rendering them incompatible for embarkation. As the angle from ramp-to-pier increases, the severity of the dip-knuckle is reduced. These "dips/knuckle" also create unsafe conditions when forklifts traverse them with pallets stacked 2-high. The "dips/knuckles" cause motions that allow the top pallet to shift and nearly topple over.

Figure 2. Starboard-Aft Quartering Ramp



#1: Ramp joint that creates the most obstructive "dip" (or knuckle) to vehicle traffic.

#2: Ramp joint that creates a second dip/knuckle.

#3: Wooden inserts were made to minimize the effect of this dip/knuckle (see #1), since it is deepest and most obstructive to vehicle transit.

(3) HSV engines emitted an excessive amount of exhaust while traveling at low speeds (loitering) that accumulated in the vehicle deck. This rendered the vehicle deck unsafe for personnel. This has environmental "safety" ramifications as well as operational concerns in that vehicle operators cannot access their vehicles to perform maintenance or execute pre-operation checks prior to offload.

(4) The vessels "rub rail" was not sufficient fendering when mooring adjacent to austere ports or causeway sections. Either a permanently installed fendering system or a crew deployable one is required.

(5) Extended high-speed transits reduce mission readiness of embarked personnel:

(a) vessel sea-keeping and stability at high-speeds and/or in sea state-3 (+) increases the discomfort, nausea, and fatigue among embarked personnel.

(6) Currently, the onload/offload of "breakbulk" cargo is slow and time consuming.

(7) The pivoting action of the AAV on the vehicle deck can damage the protruding "tie-down" system.

(8) Personnel, vehicles, and cargo embark/debark the HSV via the starboard-aft quartering ramp. For safety reasons all vehicle/cargo traffic must halt while personnel cross the ramp. Though not a significant problem, it does slow the loading process. During missions where time is a factor any delay could be critical.

(9) The metal-to-metal contact between the HSV and causeway sections (RRDF, floating pier, etc.) are a mooring concern due to the likelihood of hull punctures.

(10) The location of the support beams in the main vehicle deck create obstructions to onload-offload operations:

(a) support beams for the flight deck are anchored amidships in the vehicle deck. This positioning creates an unnavigable turn at the forward end of the main vehicle deck for trucks with long-bed trailers (i.e. M870, M970) rendering them incompatible for embarkation. It also slows the embarkation of other vehicles with trailers as they are forced to utilize a 3-point turn to transit the area.

(11) During high tides, vehicle operators frequently lost visibility of ground guides and/or the ramp during transits aboard ship.

(12) The 'Centerline' Mezzanine Deck is an 'overhead' obstacle to an LVS (Mk48/14) with a mobile loaded ISO container transiting the Main Vehicle Deck. The 'Centerline' Mezzanine Deck is **13' 3"** above the Main Vehicle Deck whereas the LVS (Mk48/14) with mobile loaded ISO container has a vertical height of **13' 4"**.

(13) The M915 truck lost traction when transiting the ramp's "dip/knuckle". The trailer also has an underside "tool bin" that could not clear the ramp's "dip/knuckle".

(14) The M870 trailer has three rows of parallel rear axles. At certain tidal ranges, as the trailer transits the "dip/knuckle" of the ramp, the two "inboard" axles of the trailer lose contact with the ramp. This puts the entire weight of the trailer cargo on a single axle vice three. It is foreseeable that damage could result if the axle's capacity is exceeded by the cargo. Had the ramp been completely straight (no dips/knuckles) this particular problem would not be an issue.

(15) To maneuver through confined and restricted waterways the HSV has better visibility over the stern of the vessel vice the bow.

(16) It was observed during a passenger offload from the CH46 that there may be insufficient deck space to offload cargo (pallets) or casualty litters. Further observations are required to verify this deficiency.

(17) The use of a single "overhanging crane system" to launch and recover multiple "small boats (CRRC)" is time consuming and possibly hazardous in high sea-states or hostile enemy environments.

(18) The "Overhead Crane System" demonstrated the following deficiencies:

- (a) As currently designed the "manual" attachment and detachment of lifting slings by CRRC coxswains is time consuming (in any environments) and a safety hazard in sea state-2 or higher or at night.
- (b) The engine noise created by the "Overhead Crane" is excessive and limits verbal communication in the Main Vehicle deck.
- (c) Poor lighting exists on the Main Vehicle deck, on the boat operating area around the HSV, and on the crane block itself during night boat launches and recoveries. This creates a hazardous situation for HSV and boat crews.
- (d) The loading and offloading of small boat passengers (i.e. recon Marines) is extremely hazardous at night or in sea states-2 or higher. Passengers must traverse (jump) a vertical distance of 4-5 feet between the HSV Port quarter and the small boat (see Figure 3).

Figure 3. Marine Recon debarking CRRC



CRRC embark & debark requires crew assistance.

(19) The crew manning structure aboard the *Joint Venture* does NOT allow the "simultaneous" launch/recovery of small boats (via overhead crane) AND the onload/offload of small boat passengers (via port quarter). Each event (boat launch/recover or pax onload/offload) must be completed before the other can commence.

c. Recommendations. The following "selected" modifications and enhancements are considered more significant to the concept development and mission refinement process. A detailed listing of all recommendations can be found in the enclosures to this report.

- (1) Enclose the Vehicle Deck to protect embarked equipment and cargo from the damaging and corrosive effects of extreme environments (rain, wind, salt fog, etc.).
- (2) Enhance the ventilation system in the Vehicle deck or correct the engine exhaust problem that occurs at low speeds.
- (3) Improve the sea-keeping and stability of the vessel during high-speed transits in order to maintain the mission readiness of embarked personnel. Otherwise reducing the length of time embarked personnel remain aboard during high-speed transits is recommended. Continued assessment of Quality of Life issues will more precisely define and correlate the time, speed, distance, and sea-keeping factors as they relate to mission readiness issues.

(4) When offload time is critical, either restrict the embarkation of large quantities of breakbulk cargo or require all such cargo to be packaged in manageable "quad-container or ISO container" systems for embark aboard the HSV.

(5) Install a stern ramp that traverses port, starboard and straight astern as required. This will enhance HSV mooring flexibility and compatibility with vehicles that require a longer turning radius. The ramp should also be modified to reduce "dips/knuckles" that are created as a result of varying tidal ranges. A level and even ramp will be more accessible to vehicles and trailers with low clearances. This type ramp will also facilitate the onload of ISO containers.

(6) Minimize the obstructions to maneuverability (i.e. centerline stanchions, ship support equipment, etc.) within the vehicle deck. This will enhance the loading, staging and offloading process. It could also increase usable deck space.

(7) Install a separate access ramp for personnel that avoids the vehicle deck.

(8) If utilization of the flight deck for personnel/cargo transfer, vertical replenishment, and MAGTF mission support tasks is determined to be a critical capability, then the installation of an elevator to/from the vehicle deck is highly recommended

(9) Provide a crew deployable "fendering" system or enhance the "rub rail" on the vessels exterior to increase compatibility with austere ports and causeway sections.

(10) Provide the vessel with organic Material Handling Equipment (MHE) to assist in onloads, offloads and cargo reorganization.

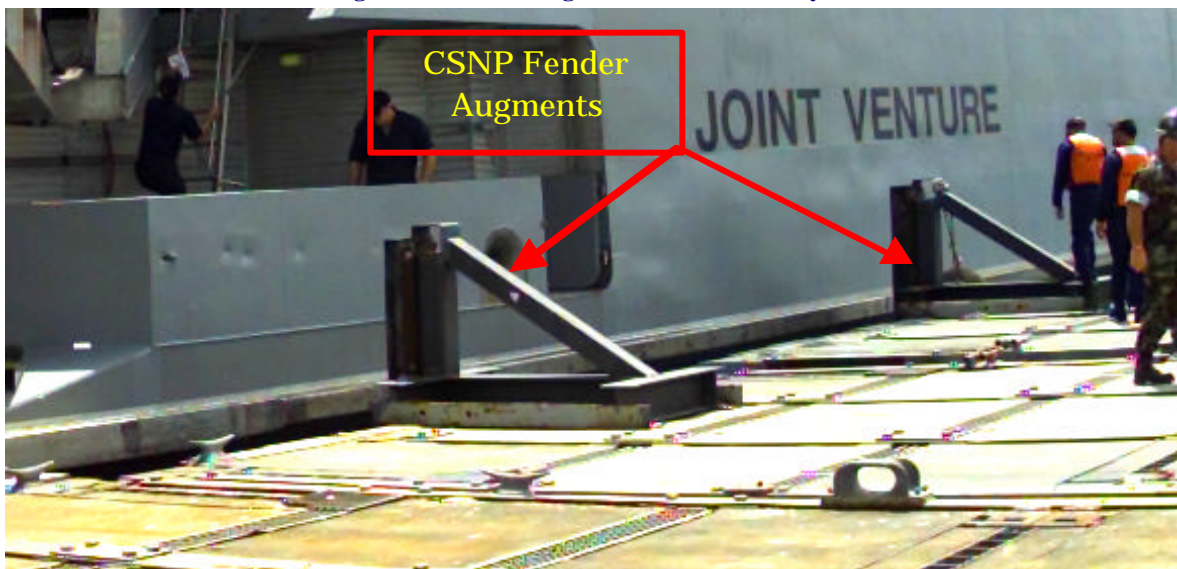
(11) A multi-boat "launch and recovery" system should be provided to enhance HSV mission capabilities and reduce potential hazards.

(12) Restructure the crew manning levels (as required) to allow the simultaneous launching and loading of small boats.

(13) Increase the vertical clearance in the Main Vehicle Deck to fifteen (15) feet to ensure access by all USMC Ground Tactical Vehicles with mobile loads.

(14) Develop an "augmentation" package for causeway sections that can be easily attached by the Amphibious Construction Battalion (ACB) to prevent metal-to-metal contact between causeway sections (RRDF, floating pier, etc.) and the HSV (see Figure 4).

Figure 4. Fender Augments to the Causeway Pier



(15) Recommend the following modifications to the "Overhead Crane System":

- (a) If the crane system is maintained, redesign the lift sling attachment-detachment process to enhance minimize time and reduce associated safety hazards.
- (b) Reduce the engine noise created by the crane to enhance verbal communication and reduce possible confusion in the Main Vehicle deck.
- (c) During night operations appropriate "blackout" lighting is required in the Main Vehicle deck, the boat launch area (surrounding sea), and on the crane block. Lighting should satisfy tactical requirements and visibility concerns.
- (d) If utilization of the port quarter area is too be retained as the passenger onload-offload point for small boats, then the installation of a safe and manageable embark-debark system or procedure is required.

(16) To enhance speed and vessel maneuverability in confined/restricted waterways, relocate the bridge, or provide an alternate bridge, that offers appropriate visibility over the bow.

6. **System Evaluation.** The HSV has successfully demonstrated the capability to provide greater operational mobility, theater logistics support, and additional force closure options in the conduct of expeditionary operations. Continued experimentation in Fiscal Year 2003 (FY03) with HSV technology would provide significant evaluation of the vessel's interoperability with Amphibious Readiness Group (ARG) shipping, the Maritime Prepositioning Force (MPF) and seabased logistics platforms.

7. Point of contact: Major J.B. Stone IV, Robert Bickel, or John Goetke at 784-1088/1089.

J. B. Stone IV
Major USMC

ADMINISTRATIVE MESSAGE

ROUTINE

R 050930Z NOV 01 ZYB PSN 741215M20

FM CG MCCDC QUANTICO VA//WDID//

TO CMC WASHINGTON DC//PPO/I&L/AVN//
COMMARFORLANT//G3/G4/G5/G8//
COMMARFORPAC//G3/G4/G5/G8//
COMMARFOREUR//G3/G4/G5//
COMMARFORSOUTH//G3/G4/G5//
COMMARFORCENT//G3/G4/G5//
COMMARFORRES//G3/G4/G5//
CG MCWL QUANTICO VA//PLANS/OPS//
CMC WASHINGTON DC//PPO/I&L/AVN/POE/LPO/LPV/LFT/ASL//
CNR ARLINGTON VA//CODE 353//
NAVSURFWARCEN CARDEROCKDIV BETHESDA MD

INFO CG I MEF//G3/G4/G5//
CG II MEF//G3/G4/G5//
CG III MEF//G3/G4/G5//
MARCORSYSCOM//COS//
COMNAVWARDEVCOM NEWPORT RI
COMMARCOMATCOM ALBANY GA//OPS//
BLOUNT IS CMD JACKSONVILLE FL
NAVTRANSSUPPCEN NORFOLK VA
NFESC PORT HUENEME CA
NAVSURFWARCENDIV PORT HUENEME CA
CG MCCDC QUANTICO VA//C41//

UNCLAS //N03500//

MSGID/GENADMIN/HSVCAMPLAN/OCT//

**SUBJ/CONCEPT OF OPERATIONS FOR USMC JOINT HIGH SPEED VESSEL
(JHSV)EXPERIMENTATION: JOINT VENTURE (HSV-X1)//**

REF/A/MSG/CMC WASHINGTON DC/301433Z AUG01/NOTAL//

REF/B/MSG/COMMARFORLANT/131430ZJ UN01/NOTAL//

REF/C/MSG/CINCLANTFLT/122024Z OCT01/NOTAL//

REF/D/MOA/MEMORANDUM OF AGREEMENT 10 OCT 01//

NARR/REF A PROVIDED FRAMEWORK FOR USMC OPERATIONAL EMPLOYMENT OF JHSV. REF B NOMINATED VENUES FOR JHSV EXPERIMENTATION. REF C IS THE ISIC ASSIGNMENT FOR HSV-X1. REF D IS THE AGREEMENT BETWEEN SPONSORING AGENCIES FOR ADMINISTRATION OF THE JHSV PROJECT// POC/L.S.RYDER/MAJOR MCCDC JCDE OFFICE SUFFOLK TEL DSN 565-4261 /TEL: CML (757) 445-4261/EMAIL: RYDERLS@MARFORLANT.USMC.MIL// POC/M.J. JOHNSON/MAJOR/MCCDC JT OPS CTR QUANTICO/TEL: DSN 278-5219 /TEL: CML 703 784-5219 /EMAIL: JOHNSONMJ@MCCDC.USMC.MIL//

RMKS/1. THIS IS A COORDINATED MARINE FORCES, D/C PP&O, D/C I&L AND CG MCCDC (D/C CBT DEV) JOINT CONCEPT DEVELOPMENT AND EXPERIMENTATION EFFORT (JCDE).

2. PURPOSE. TO PUBLISH THE JOINT HIGH SPEED VESSEL (JHSV) CONOPS PER REF A. SPECIFICALLY, THIS MESSAGE:

- A. PROVIDES BACKGROUND ON JHSV
- B. PROVIDES CONOPS FOR JHSV
- C. IDENTIFIES JHSV EXPERIMENTAL VENUES AND PARTICIPATING USMC UNITS

3. BACKGROUND.

A. SINCE MARCH 01 NAVY AND MARINE STAFFS (MARFORS, ADVOCATES, HQMC, MCCDC) HAVE PARTICIPATED IN A SERIES OF PLANNING VENUES THAT DESIGNED AND COORDINATED THE JHSV EXPERIMENTATION. AN ACCEPTANCE CEREMONY FOR JOINT VENTURE (HSV-X1) WAS HELD ON 11 OCT 01 AT NAB LITTLE CREEK. JOINT VENTURE IS A 313 FOOT COMMERCIAL FERRY CAPABLE OF SUSTAINED SPEEDS IN EXCESS OF 40 KNOTS. THE VESSEL HAS BEEN LEASED AND HAS UNDERGONE MODIFICATIONS TO ENHANCE THE VESSEL'S MILITARY UTILITY. SPECIFIC CAPABILITIES INCLUDE ABILITY TO LAUNCH/RECOVER SMALL BOATS, ABILITY TO EMBARK AAVS AND ABILITY TO CONDUCT DAY VFR FLIGHT OPS WITH CH-46 AIRCRAFT.

B. HSV-X1 RELATION TO OTHER HIGH SPEED VESSEL (HSV) EFFORTS. THE VISIBILITY OF POTENTIAL HSV CAPABILITIES IS RAPIDLY GROWING. FOR EXAMPLE, THE U. S. ARMY HAS POM'D FOR A HIGH SPEED VESSEL (DESIGNATED THE THEATER SUPPORT VESSEL) IN FY04. HIGH SPEED VESSELS HAVE BEEN EMPLOYED NOTIONALLY BY MARFOR COMMANDERS IN SEVERAL WARGAMES INCLUDING GLOBAL 2000, GLOBAL 2001, AND UNIFIED VISION 2001. III MEF HAS ALSO SIGNED A LEASE TO USE A COMMERCIAL HIGH-SPEED FERRY (WESTPAC EXPRESS) TO CONDUCT INTRATHEATER DEPLOYMENTS FOR TRAINING EXERCISES OFF OKINAWA, JAPAN. THE III MEF EFFORT IS COMPLEMENTARY AND FOCUSED PRIMARILY ON INTRATHEATER MOVEMENT. THE JHSV CAMPAIGN EXPLORES THE OPERATIONAL EMPLOYMENT OF HIGH-SPEED VESSELS IN A WIDE RANGE OF MISSIONS. IN ORDER TO BEST LEVERAGE THE JHSV AND III MEF HSV INITIATIVES, CG MCCDC WILL INTEGRATE THESE

EFFORTS AND CONSOLIDATE INFORMATION (I.E. ASSESSMENT RESULTS) AS REQUIRED.

4. SITUATION. THROUGHOUT THE NEXT 12 MONTHS, COMPONENT COMMANDS FROM THE MARINE CORPS, ARMY, NAVY, JOINT SPECIAL OPERATIONS COMMAND AND THE COAST GUARD WILL CONDUCT JOINT EXPERIMENTS THAT WILL EXPLORE THE OPERATIONAL IMPLICATIONS AND OPPORTUNITIES OF NEW MARITIME TECHNOLOGIES. THE EXPERIMENTS WILL LOOK AT THE FUTURE CAPABILITIES AND POTENTIAL OPERATIONAL IMPACT THAT HIGH SPEED VESSELS SUCH AS THE JOINT VENTURE (HSV-X1) PROVIDES.

5. MISSION. TO CONDUCT HIGH SPEED VESSEL (HSV) EXPERIMENTATION IN ORDER TO DEVELOP NAVAL EXPEDITIONARY CONCEPTS AND CAPABILITIES FOR FUTURE JOINT FORCE COMMANDERS.

6. INTENT. TO EXPERIMENT WITH HSV CAPABILITIES WITHIN THE CONTEXT OF EXPEDITIONARY MANEUVER WARFARE (EMW) AND NETWORK CENTRIC WARFARE (NCW). I EXPECT THE HSV-X1 AND III MEF HSV EFFORTS TO PROVIDE INSIGHTS INTO HIGH SPEED VESSEL IMPACTS ON FUTURE OPERATIONAL CONCEPTS THROUGHOUT THE DEPLOYMENT, EMPLOYMENT, SUSTAINMENT AND REDEPLOYMENT CYCLE. I ALSO EXPECT TO EXPLORE FUTURE HSV TACTICS, TECHNIQUES, PROCEDURES AND TECHNOLOGIES (TTPT) AND THE COMPLEMENTARY NATURE OF HSV WITH AMPHIBIOUS AND MPF PLATFORMS.

7. ENDSTATE. TO MAKE MARINE CORPS RECOMMENDATIONS ON THE FUTURE ROLE OF HIGH SPEED VESSELS TO INCLUDE APPROPRIATE DOTMLPF (DOCTRINE, ORGANIZATION, TRAINING, MATERIAL, LEADERSHIP, PERSONNEL, FACILITIES) INITIATIVES.

8. CONCEPT OF OPERATIONS.

A. OVERVIEW. THE FY2002 JHSV EXPERIMENTATION WILL BE CONDUCTED IN FOUR PHASES, IN CONUS AND OCONUS VENUES, UNDER THE OPERATIONAL CONTROL OF COMMANDER-IN-CHIEF U.S. ATLANTIC FLEET (CINCLANTFLT), COMMANDER-IN-CHIEF U.S. PACIFIC FLEET (CINCPACFLT), AND THE COMMANDING GENERAL, U.S. ARMY TRANSPORTATION CENTER & FORT EUSTIS (CGUSATCFE):

PHASE I: 05 OCT 01 - 15 MAR 02 CINCLANTFLT

PHASE II: 15 MAR 02 - 07 JUL 02 CGUSATCFE

PHASE III: 07 JUL 02 - 07 AUG 02 CINCPACFLT

PHASE IV: 07 AUG 02 - 09 OCT 02 CGUSATCFE

B. SCHEME OF MANEUVER. MARINE CORPS EXPERIMENTATION IS CONDUCTED IN SEVEN LIMITED OBJECTIVE EXPERIMENTS (LOE'S) SPREAD THROUGHOUT PHASES I AND III (ABOVE). THE USMC LOE'S ARE DESIGNED AROUND SIX MAJOR OBJECTIVES:

- (1) PIERSIDE INTEROPERABILITY
- (2) LIGHTERAGE INTEROPERABILITY
- (3) MPF INTEROPERABILITY
- (4) INTRA-THEATER LIFT INTEROPERABILITY
- (5) AMPHIBIOUS INTEROPERABILITY
- (6) SEA-BASING INTEROPERABILITY

LOE EXPERIMENT/LOCATION/DATE

PARTICIPATING UNITS

- | | | |
|-----|---|--|
| (1) | PIERSIDE INTEROPERABILITY
NAB-LITTLE CREEK VA
18-19 OCT 01 | MARFORRES
NAVBCHGRU-2
PHIBRGU-2
PHIBCB-2
ACU-2
ARMY 7TH TRANS GROUP |
| (2) | LIGHTERAGE INTEROPERABILITY
NAB-LITTLE CREEK VA
25-26 OCT 01 | MARFORRES
NAVBCHGRU-2
PHIBGRU-2
PHIBCB-2
ACU-2
ARMY 7TH TRANS GROUP |
| (3) | MPF INTEROPERABILITY
(ONLOAD)
MOREHEAD CITY NC
26-27 NOV 01 | II MEF
SS PLESS
MSC |
| (4) | MPF INTEROPERABILITY
TRANSIT & OFFLOAD)
MOREHEAD CITY NC
BLOUNT ISLAND CMD/MAYPORT
28-29 NOV 01 | II MEF
2D FSSG
SS PLESS
BLOUNT ISLAND CMD |
| (5) | INTRA-THEATER LIFT
EUCOM-NORWAY
(BATTLE GRIFFEN/STRONG
RESOLVE)
FY02/2QTR | II MEF
SS PLESS
MARFOREUR
NALMEB |
| (6) | AMPHIBIOUS INTEROPERABILITY
TYPE CMDR TRNG (TCAT)
FY02/3QTR | II MEF
2D FSSG
2D MARDIV
NAVBCHGRU-2
PHIBCB-2
ACU-2 |
| (7) | SEA-BASING INTEROPERABILITY
MILLENNIUM CHALLENGE 02
JUL-AUG 02 | MARFORLANT
I MEF
II MEF
NAVBCHGRU-1
PHIBCB-1
ACU-1 |

6. TASKS. THE JHSV TASKS VARY DEPENDING ON THE PARTICULAR LOE. THE LOE ASSIGNMENTS AND TASKS HAVE BEEN COORDINATED WITH THE EXECUTING UNITS BY THE CORE IPT. JHSV LOE AND MC02 DETAILS WILL BE PUBLISHED VIA SEPCOR. USMC CORE IPT MEMBERS ARE:

NAME-RANK	ORGANIZATION	DSN
COL FRANK DIFALCO	MCCDC (JOINT OPS CTR, QUANTICO)	278-0241
MAJ LARRY RYDER	MCCDC (JCDE OFFICE, SUFFOLK)	565-4261

MAJ MARK JOHNSON	MCCDC (JOINT OPS CTR, QUANTICO)	278-3610
MAJ RUDOLF WEBBERS	PP&O (POE)	225-2051
MAJ CHRIS WAGNER	I&L (LPV)	225-6019
MAJ ROD HENDRICK	MCCDC (AMPH RQMTS)	278-6212
MAJ TIM JAMES	MCWL (EXPERIMENT SUPPORT)	278-5176
MR RANDY BICKEL	MCWL (EXPERIMENT TECH)	278-1088
MRS. MO HARBAC	MCWL (EXPERIMENT PLANS)	278-1467
LTCOL JIM CALLAWAY	MARFORLANT (G3/G5)	836-0733

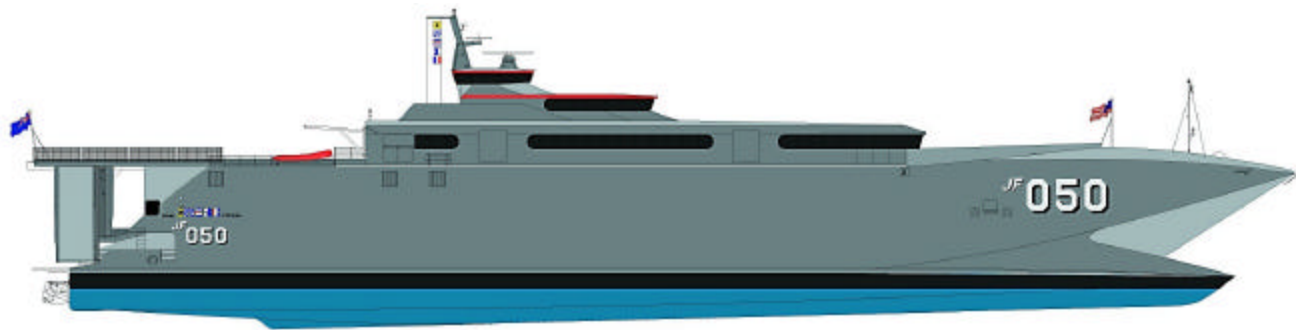
7. FUNDING. ONR IS PROVIDING HSV-X1 LEASE AND VESSEL MODIFICATION FUNDING. USMC HSV-X1 LOE OPERATING COSTS (FUEL, BERTHING EXPENSES, PORT & PILOT FEES, ETC.) ARE CURRENTLY BEING FUNDED BY NWDC. USMC FORCES PARTICIPATING IN THE LOE'S ARE RESPONSIBLE FOR UNIT INCURRED COSTS. CG MCCDC IS PURSUING ADDITIONAL USMC FUNDING OPTIONS.

8. COMMAND RELATIONSHIPS. THE OVERARCHING JHSV COMMAND RELATIONSHIP IS GOVERNED BY THE MOA (REF D. WITHIN THE MARINE CORPS, MCCDC (DEPUTY COMMANDANT FOR COMBAT DEVELOPMENT (DESIGNATE)) IS THE OVERALL LEAD FOR THE MARINE CORPS IN THE JHSV CONCEPT DEVELOPMENT AND EXPERIMENTATION. KEY SUPPORT IS PROVIDED BY THE OPERATING FORCES/FLEET MARINE FORCES, MARINE FORCES RESERVE, HEADQUARTERS MARINE CORPS, AND THE MARINE CORPS WARFIGHTING LABORATORY. COMMARFORLANT IS THE USMC COMPONENT COMMANDER AND, AS APPROPRIATE, COORDINATES USMC FORCE PARTICIPATION IN THE JHSV LIMITED OBJECTIVE EXPERIMENTS AND MILLENNIUM CHALLENGE 02.//

BT
NNNN

Quick-Look Report: Joint High Speed Vessel

(Vehicle Interoperability)



Robert Bickel
SSgt Kevin Ashley

15 November 2001

Marine Corps Warfighting Lab, Quantico, Virginia

LOE Phase 1.A. (Vehicle Interoperability)

18 Oct 01

Event #	Event Description	Method	Data Evaluation
1.	"Single" vehicle compatibility/maneuverability: A. Starboard Aft Quartering Ramp B. Main Vehicle Deck C. Internal Ramps D. Mezzanine Deck	<i>Note: Prior to all RO/RO events a DC will measure the height between the vehicle deck and pier in order to determine tide effects on ramp angle.</i>	* The Ops Log will be used for detailed explanations of any Discrepancy or Unknown values. ** For appropriate "turning" maneuverability, it has been determined that a 5-point turn is the maximum allowed for favorable assessment aboard the JHSV.
1.A 1.A (1)	Starboard Aft Quartering Ramp (1) Verify that ramp deployment is unassisted.	(1) DC's will observe ramp deployment.	(1) Was ramp <u>deployment</u> assisted by equipment external to the HSV? <u>No</u> : Ramp deployment was unassisted.
1.A (2)	(2) Determine ramp preparation/deployment time	(2) DC's will time ramp preparation & deployment.	(2) Ramp deployment time: <i>Two ramp deployments were observed:</i> <u>1. 29 min 15 sec</u> <u>2. 12 min 37 sec</u>
1.A (3)	(3) Determine ramp compatibility with Pier.	(3) Observations will be made regarding any unusual actions that occur between the ramp and pier. All systems that are adjoined to the pier will be considered a component of the and will be assessed accordingly.	(3) Did the ramp -pier interface create any unusual actions (flexing, lateral/vertical movement, bending/ buckling, pier or ramp damage)? <u>Unk</u> : Wave action within basin caused fore-aft movement of the ramp on pier. Constant scraping of ramp on concrete. No damage to ramp or pier observed. Long term effect unknown.

Marine Corps Warfighting Lab, Quantico, Virginia

Event #	Event Description	Method	Data Evaluation
1.A (4)	(4) Determine vehicle maneuverability and compatibility with stern ramp.	(4) As vehicle transits ramp from pier, DC observations will be made regarding traction, contact with ramp sides, ramp stability or any other unusual actions that occur.	<p>(4) During transit over the ramp did any vehicle experience a loss of traction, bottom contact or near contact with ramp surface, curbs, overhead, stanchions, cables, etc)?</p> <p>IFAV: <u>No</u> M998 HMMWV: <u>No</u> M923: <u>No</u> M923/welding trlr: <u>No</u></p> <p>M915/M872 trlr: <u>Yes</u>: While transiting the starboard aft quartering ramp the left rear tires of the M915 Truck, Tractor experienced a momentary "loss of traction" but successfully traversed the ramp. However, as the M872 trailer attempted to transit ramp the "stowage box" mounted on the left side of the trailer undercarriage could not clear the first "knuckle" (i.e. elevated flex point) of the ramp. Tractor and trailer were backed off the ramp and disqualified from further testing as "<u>non-accessible</u>" equipment.</p> <p>AAV: <u>No</u> EBFL (ATLAS): <u>No</u> RT-4000 Forklift <u>No</u></p>
1.A (5)	(5) Verify ramp recovery is unassisted.	(5) DC's will observe ramp recovery.	<p>(5) Was ramp <u>recovery</u> assisted by equipment external to the HSV?</p> <p><u>No</u>: Ramp recovery was unassisted</p>
1.A (6)	(6) Determine ramp preparation/recovery time.	(6) DC's will time preparation & recovery.	<p>(6) Ramp recovery time: (<i>One ramp recovery observed</i>)</p> <p>1. <u>11 min</u> <u>15 sec</u></p>

Marine Corps Warfighting Lab, Quantico, Virginia

Event #	Event Description	Method	Data Evaluation
1.B 1.B (1)	Main Vehicle Deck (Single Vehicle ONLY) (1) Maneuverability within main stowage .	(1) A single test vehicle will transit the ramp from the pier. Once each vehicle successfully transits ramp it will maneuver around the main deck and under the centerline ramp as directed by ground guides. Maneuverability will encompass turning radius, parking, backing, visibility, etc,.	(1) During transit through the main deck did any vehicle experience maneuverability problems: -poor visibility -more than 5-point turns -loss of traction -contact with bulkheads-stanchions -cause damage to pad-eyes IFAV: <u>No</u> M998 HMMWV: <u>No</u> M923: <u>No</u> <i>*Note. The M923(without trailer) had to make two (2) 5-point turns to traverse the main vehicle deck.</i> M923/welding trlr: <u>Unk.</u> The M923/welding trailer was unable to navigate the forward turning area of the main vehicle deck. The welding trailer had to be disconnected from the truck and debarked by the ATLAS (EBFL) forklift. Embark SME's have determined that the position of two (2) ISO containers was such that they restricted the turning radius of the truck/trailer. Therefore, this event should be re-evaluated at the next LOE. <u>No conclusions</u> will be drawn as to this vehicles maneuverability on the main vehicle deck until follow-on testing is concluded. <i>*Note. The M923/welding trailer was disqualified from further testing during this LOE.</i> AAV: <u>Yes.</u> The AAV's caused damage to the "beer can" pad-eyes while pivoting to maneuver through the main deck. The aluminum pad-eyes were gouged, dented, and split in various areas. If it is determined to maintain this tie-down system then the only measure to prevent damage is to use wooden dunnage to cover the pad-eyes during AAV operations. This increases onload-offload time and may be a limiting factor to load plans. EBFL (ATLAS): <u>No</u> RT-4000 Forklift <u>No</u>

Marine Corps Warfighting Lab, Quantico, Virginia

Event #	Event Description	Method	Data Evaluation
1.B (2)	(2) Adequacy of vehicle overhead clearances.	(2) As vehicles transit the main stowage area DC's will observe overhead clearances and potential obstructive areas.	<p>(2) As vehicles transit the main stowage area did any vehicle experience maneuverability problems due to overhead obstructions?</p> <p> IFAV: <u>No</u> M998 HMMWV: <u>No</u> M923: <u>No</u> AAV: <u>No</u> EBFL (ATLAS): <u>No</u> RT-4000 Forklift <u>No</u> </p>
1.C 1.C (1)	Mezzanine Ramps (1) Compatibility of "internal" ramps with vehicles.	(1) Following maneuverability in the main stowage area, individual test vehicles will transit the mezzanine ramps to access upper stowage areas. DC observations will be made regarding traction, contact with ramp sides, ramp stability or any other unusual hindrances to maneuverability.	<p>(1) As vehicles transit the mezzanine ramps did any vehicle experience maneuverability problems?</p> <ul style="list-style-type: none"> -poor visibility -more than 5-point turns -loss of traction -contact with bulkheads-stanchions -cause damage to pad-eyes <p> IFAV: <u>No</u> M998 HMMWV: <u>No</u> </p>
1.C (2)	(2) Adequacy of vehicle overhead clearances while transiting the mezzanine ramps .	(2) As vehicles transit the mezzanine ramps , DC's will observe overhead clearances and potential obstructive areas.	<p>(2) As vehicles transit the mezzanine ramps did any vehicle experience maneuverability problems due to overhead obstructions?</p> <p> IFAV: <u>No</u> M998 HMMWV: <u>No</u> </p>

Marine Corps Warfighting Lab, Quantico, Virginia

Event #	Event Description	Method	Data Evaluation
1.D 1.D(1)	Mezzanine Deck (1) Maneuverability within mezzanine deck area.	(1) Once vehicle successfully transits deck area it will maneuver through the mezzanine deck as directed by ground guides. Maneuverability will encompass turning radius, parking, backing, visibility, etc.,	(1) During transit through the mezzanine deck area did the vehicle experience any maneuverability problems: -poor visibility -more than 5-point turns -loss of traction -contact with bulkheads-stanchions -cause damage to pad-eyes IFAV: <u>No</u> M998 HMMWV: <u>No</u>
1.D(2)	(2) Adequacy of vehicle overhead clearances while transiting the mezzanine deck area.	(2) As vehicles transit the mezzanine deck areas DC's will observe overhead clearances and potential obstructive areas.	(2) During transit through the mezzanine deck areas did any vehicle experience maneuverability problems due to overhead obstructions? IFAV: <u>No</u> M998 HMMWV: <u>No</u> <i>*<u>Note.</u> For both IFAV and HMMWV, the top outside edges of the vehicle's roof came <u>close</u> to bulkhead support beams that have angle inserts in all corners which reduce overhead clearance in those corner areas. Contact not likely but possible if vehicle takes wide approach.</i>
2.	Multi-vehicle compatibility & maneuverability: A. Main Vehicle Deck B. Mezzanine	<i>All test vehicles will load aboard the JHSV to validate staging capabilities and maneuverability when deck space is minimized or obstructed by other vehicles.</i>	

Marine Corps Warfighting Lab, Quantico, Virginia

Event #	Event Description	Method	Data Evaluation
2.A 2.A(1)	Main Vehicle Deck (Multiple Parked Vehicles) (1) Maneuverability within main stowage.	(1) Single test vehicle will transit the ramp from the pier. With maneuver space minimized by parked vehicles/cargo, each test vehicle will attempt to traverse and park in various locations of the main deck . Maneuverability will encompass turning radius, parking, backing, visibility, etc.,	<p>(1) During transit and staging on the main deck did the vehicle experience any maneuverability problems:</p> <ul style="list-style-type: none"> -poor visibility -more than 5-point turns -loss of traction -contact with bulkhead-stanchion-other vehicles -cause damage to pad-eyes -able to access designated staging spots <p>IFAV: <u>Unk</u> Concern for <u>possible</u> damage to IFAV size vehicles staged on the Mezzanine ramp and deck during at-sea transits. Vehicle overhead clearance is minimal (approx 1 inch). During at-sea transits any vertical motion will cause vehicle contact with overhead and possible damage. Appropriate tie-downs or increased overhead clearance is recommended.</p> <p>M998 HMMWV: <u>Unk</u> There is concern for possible damage to HMMWV size vehicles staged on the Mezzanine <u>ramp</u> and <u>deck</u> during at-sea transits. Vehicle overhead clearance is minimal in these areas (approx. 1 inch). During at-sea transits any vertical motion will cause vehicle contact with the overhead and possible damage to the vehicle. Appropriate tie-downs or increased overhead clearance is recommended.</p> <p>M923: <u>No</u></p> <p>AAV: <u>Unk</u> While backing under the Hoistable Ramp it was noted that the top most part of the AAV turret <u>appeared</u> to be in "near contact" with a "slack" overhead cable. The AAV did not back-up a sufficient distance to actually determine if contact would have been made, but SME observation identified the possibility. Future LOE's with AAV's should re-examine and verify.</p> <p>EBFL (ATLAS): <u>Unk</u> When the ATLAS (EBFL) came aboard to remove the welding trailer from the M923, it was noted that the ATLAS forks were still down and extended. This configuration made maneuverability in the forward areas of the vessel more difficult. A hydraulic malfunction on the ATLAS prevented the operator from raising the forks.</p> <p>RT-4000 Forklift <u>No</u></p>

Marine Corps Warfighting Lab, Quantico, Virginia

Event #	Event Description	Method	Data Evaluation
2.A(2)	(2) Suitability of lashing, tie-downs, pad-eyes.	(2) Once vehicles have successfully parked in designated locations the operators will attach appropriate tie-downs. DC's will assess the use of these tie-downs as maneuverability obstructions, deck space restrictions, stability enhancement, etc.,. DC's will assess pad-eyes regarding location, quantity, strength, etc.,.	<p>(2) For each vehicle, were tie-down devices:</p> <ul style="list-style-type: none"> -compatible -functional -operable -obstructive to maneuvering vehicles -squander / waste stowage space <p> IFAV: <u>Unk</u> M998 HMMWV: <u>Unk</u> M923: <u>Unk</u> AAV: <u>Unk</u> EBFL (ATLAS): <u>Unk</u> RT-4000 Forklift <u>Unk</u> </p> <p><i>*Note. Appropriate tie-down devices were NOT available for testing. However, they may be <u>required</u> for IFAV / HMMWV sized vehicles on the Mezzanine ramp and deck during at-sea transits. Vehicle overhead clearance is minimal in these areas (about 1 inch). During at-sea transits any vertical motion will cause contact and possible damage to the vehicle. Appropriate tie-downs may reduce the vehicles "vertical" motion and therefore "reduce (not eliminate)" subsequent damage.</i></p>
2.A(3)	(3) Suitability of staged vehicles on main deck	(3) After vehicles are staged, DC's will assess accessibility by operators/maintainers, efficient use of available deck space, proximity to obstructions (Horizontal/vertical), etc.,.	<p>(3) After vehicles were staged was personnel accessibility restricted by proximity to other vehicles or obstructions (i.e. operator and maintainer access):</p> <p> IFAV: <u>No</u> M998 HMMWV: <u>No</u> M923: <u>No</u> AAV: <u>No</u> EBFL (ATLAS): <u>No</u> RT-4000 Forklift <u>No</u> </p> <p><i>*Note. At least one side of every vehicle was accessible by personnel.</i></p>

Marine Corps Warfighting Lab, Quantico, Virginia

Event #	Event Description	Method	Data Evaluation
2.B 2.B(1)	Mezzanine Ramp (1) Maneuverability & staging on Mezzanine ramps	(1) Single test vehicle will transit the ramp from the main vehicle deck to the Mezzanine. With maneuver space minimized by parked vehicles/ cargo, each test vehicle will attempt to traverse and park at designated locations on the Mezzanine ramp . Maneuverability will encompass turning radius, parking, backing, visibility, etc.,	(1) As vehicles transit the mezzanine ramps did staged vehicles present any maneuverability problems: -poor visibility -more than 5-point turns -loss of traction -contact with bulkhead-stanchion-other vehicles -cause damage to pad-eyes IFAV: <u>No</u> M998 HMMWV: <u>No</u> <i>*Note. No problems observed, however, at certain locations on the ramps, transit around staged vehicles required some 3-point turns to navigate.</i>
2.B(2)	(2) Suitability of lashing, tie-downs, pad-eyes on Mezzanine ramp .	(2) Once vehicles have successfully parked in designated locations on the Mezzanine ramp , the operators will attach appropriate tie-downs. DC's will assess the use of these tie-downs as maneuverability obstructions, deck space restrictions, stability enhancement, etc., DC's will assess pad-eyes regarding location, quantity, strength, etc.,	(2) For each vehicle on the ramp , were tie-down devices: -compatible -functional -operable -obstructive to maneuvering vehicles -squander / waste stowage space IFAV: <u>Unk</u> M998 HMMWV: <u>Unk</u> <i>*Note. Appropriate tie-down devices were NOT available for testing. However, they may be required for IFAV / HMMWV sized vehicles on the Mezzanine ramp and deck during at-sea transits. Vehicle overhead clearance is minimal in these areas (about 1 inch). During at-sea transits any vertical motion will cause contact and possible damage to the vehicle. Appropriate tie-downs may reduce the vehicles "vertical" motion and therefore "reduce (not eliminate)" subsequent damage.</i>

Marine Corps Warfighting Lab, Quantico, Virginia

Event #	Event Description	Method	Data Evaluation
2.B(3)	(3) Suitability of staged vehicles on Mezzanine ramp	(3) After vehicles are parked on the Mezzanine ramp DC's will assess restricted access to operators/maintainers, efficient use of available deck space, proximity to obstructions (Horizontal/vertical), etc.,.	<p>(3) After vehicles were staged on Mezzanine ramp, was personnel accessibility restricted by proximity to other vehicles or obstructions (i.e. operator and maintainer access):</p> <p>IFAV: <u>No</u> M998 HMMWV: <u>No</u></p> <p><i>*<u>Note.</u> No problems observed, however, at certain locations on the Mezzanine deck transit around staged vehicles required some 3-point turns to navigate.</i></p>
2.C 2.C(1)	Mezzanine Deck (1) Maneuverability & staging on Mezzanine Deck .	(1) Once vehicles have successfully transited the Mezzanine ramps and parked in designated locations on the Mezzanine Deck , operators will attach appropriate tie-downs. DC's will assess this event for lost deck space, maneuverability obstruction, etc.,.	<p>(1) During transit and staging on the Mezzanine deck did any vehicle experience maneuverability problems:</p> <ul style="list-style-type: none"> -poor visibility -more than 5-point turns -loss of traction -contact with bulkhead-stanchion-other vehicles -cause damage to pad-eyes -able to access designated staging spots <p>IFAV: <u>No - Maneuverability</u> <u>Unk - Staged</u></p> <p><i>*<u>Maneuverability Note.</u> The top outside edges of the vehicle's roof came <u>close</u> to bulkhead support beams that have angle inserts in all corners which reduce overhead clearance in those corner areas. Contact not likely but possible if vehicle takes wide approach.</i></p> <p><i>*<u>Staged.</u> There is concern for possible damage to IFAV size vehicles staged on the Mezzanine ramp and deck during at-sea transits. Vehicle overhead clearance is minimal in these areas (approx. 1 inch). During at-sea transits any vertical motion will cause vehicle contact with the overhead and possible damage to the vehicle. Appropriate tie-downs or increased overhead clearance is recommended.</i></p>

Marine Corps Warfighting Lab, Quantico, Virginia

Event #	Event Description	Method	Data Evaluation
2.C(1) (cont)	(1) Maneuverability & staging on Mezzanine Deck .	(1) Once vehicles have successfully transited the Mezzanine ramps and parked in designated locations on the Mezzanine Deck , operators will attach appropriate tie-downs. DC's will assess this event for lost deck space, maneuverability obstruction, etc.,.	<p>M998 HMMWV: No - Maneuverability Unk - Staged</p> <p><i>*Maneuverability Note. The top outside edges of the vehicle's roof came <u>close</u> to bulkhead support beams that have angle inserts in all corners which reduce overhead clearance in those corner areas. Contact not likely but possible if vehicle takes wide approach.</i></p> <p><i>*Staged. There is concern for possible damage to HMMWV size vehicles staged on the Mezzanine ramp and deck during at-sea transits. Vehicle overhead clearance is minimal in these areas (approx 1 inch). During at-sea transits any <u>vertical</u> motion will cause vehicle contact with the overhead and possible damage. Appropriate tie-downs or increased overhead clearance is recommended to protect the vehicle.</i></p>
2.C(2)	(2) Suitability of lashing, tie-downs, pad-eyes	(2) Once vehicles have successfully parked in designated locations on the Mezzanine deck , the operators will attach appropriate tie-downs. DC's will assess the use of these tie-downs as maneuverability obstructions, deck space restrictions, stability enhancement, etc.,. DC's will assess pad-eyes regarding location, quantity, strength, etc.,.	<p>(2) For each vehicle on the Mezzanine deck, were tie-down devices:</p> <ul style="list-style-type: none"> -compatible -functional -operable -obstructive to maneuvering vehicles -squander / waste stowage space <p>IFAV: Unk M998 HMMWV: Unk</p> <p><i>*Note. Appropriate tie-down devices were NOT available for testing. However, they may be <u>required</u> for IFAV / HMMWV sized vehicles on the Mezzanine ramp and deck during at-sea transits. Vehicle overhead clearance is minimal in these areas (about 1 inch). During at-sea transits any vertical motion will cause contact and possible damage to the vehicle. Appropriate tie-downs may reduce the vehicles "vertical" motion and therefore "reduce (not eliminate)" subsequent damage.</i></p>

Marine Corps Warfighting Lab, Quantico, Virginia

Event #	Event Description	Method	Data Evaluation
2.C(3)	(3) Suitability of staged vehicles on Mezzanine deck .	(3) After vehicles are parked DC's will assess restricted access to operators/maintainers, efficient use of available deck space, proximity to obstructions (Horizontal/vertical), etc.,	<p>(3) After vehicles were staged on Mezzanine deck, was personnel accessibility restricted by proximity to other vehicles or obstructions (i.e. operator and maintainer access):</p> <p>IFAV: <u>No</u> M998 HMMWV: <u>No</u> <i>*Note. At least one side of every vehicle was accessible by personnel.</i></p>
2.D 2.D(1)	Centerline Hoistable Ramp (1) Maneuverability on Hoistable Ramp.	(1) Single test vehicle will transit the ramp from the main vehicle deck to the Hoistable ramp , via Mezzanine deck. With maneuver space minimized by parked vehicles/cargo, each test vehicle will attempt to traverse and park in various locations of the Mezzanine deck. Maneuverability will encompass turning radius, parking, backing, visibility, etc.,	<p>(1) During transit and staging on the Hoistable Ramp did any vehicle experience maneuverability problems:</p> <ul style="list-style-type: none"> -poor visibility -more than 5-point turns -loss of traction -contact/near contact with bulkhead-stanchion-other vehicles -cause damage to pad-eyes -able to access designated staging spots <p>IFAV: <u>Unk</u> M998 HMMWV: <u>Unk</u> <i>*Note. Prior to commencing the LOE, INCAT engineers determined that the Hoistable Ramp <u>did not</u> have the required deck strength to support any test vehicles. Therefore, the ramp was excluded form all testing.</i></p> <p><u>Recommendation:</u> (1) Increase ramp deck strength for small vehicle stowage, (2) Eliminate the ramp entirely and increase payload, (3) Provide appropriate access and utilize area as a <u>bulk cargo</u> stowage space. Otherwise the area is wasted.</p>

Marine Corps Warfighting Lab, Quantico, Virginia

Event #	Event Description	Method	Data Evaluation
2.D(2)	(2) Suitability of lashing, tie-downs, pad-eyes on the Hoistable ramp .	(2) After vehicles are parked on the Hoistable ramp , DC's will assess accessibility to operators/maintainers, efficient use of available deck space, proximity to obstructions (horizontal/vertical), etc.,	<p>(2) For each vehicle on the Hoistable ramp, were tie-down devices:</p> <ul style="list-style-type: none"> -compatible -functional -operable -obstructive to maneuvering vehicles -squander / waste stowage space <p>IFAV: <u>Unk</u> M998 HMMWV: <u>Unk</u> <i>*Note. Prior to commencing the LOE, INCAT engineers determined that the Hoistable Ramp <u>did not</u> have the required deck strength to support any test vehicles. Therefore, the ramp was excluded form all testing.</i></p>
2.D(3)	(3) Suitability of staged vehicles on Hoistable ramp	(3) After vehicles are parked DC's will assess restricted access to operators/maintainers, efficient use of available deck space, proximity to obstructions (Horizontal/vertical), etc.,	<p>(3) After vehicles were staged on Hoistable ramp, was personnel accessibility restricted by proximity to other vehicles or obstructions (i.e. operator and maintainer access):</p> <p>IFAV: <u>Unk</u> M998 HMMWV: <u>Unk</u> <i>*Note. Prior to commencing the LOE, INCAT engineers determined that the Hoistable Ramp <u>did not</u> have the required deck strength to support any test vehicles. Therefore, the ramp was excluded form all testing.</i></p>

Marine Corps Warfighting Lab, Quantico, Virginia

Event #	Event Description	Method	Data Evaluation
3.	Human Factors & Safety A. Driver visibility on stern ramp B. Driver visibility on main vehicle deck C. Driver visibility on Mezzanine ramp D. Driver visibility on Mezzanine deck E. Driver visibility on Hoistable Ramp F. Driver ability to hear ground guide directions G. Ventilation on main vehicle deck H. "Fire Lanes" on main vehicle deck I. "Fire Lanes" on Mezzanine deck J. "Fire Lanes" on Hoistable Ramp		
3.A 3.A(1)	Driver visibility on stern ramp (1) Suitability of driver visibility of Ground Guide.	(1) DC observation & Driver/Ground Guide survey	(1) Was driver visibility of the ground guide <u>obstructed</u> during transit over the stern ramp? M923: <u>Unk</u> During one (1) transit "up" the starboard aft quartering ramp, the driver "briefly" lost visibility of the ground guide. It was determined that the ground guide was too close to the vehicle as it climbed the ramp. Once the M923 exited the ramp onto the main vehicle deck visibility was regained. The LOE Safety Officer corrected the Ground Guide. No further visibility problems were observed or reported.
3.A(2)	(2) Suitability of driver visibility of Ramp and sides.	(2) DC observation & Driver/Ground Guide survey	(2) Was any vehicle drivers visibility of the ramp and ramp sides obstructed during transit over the stern ramp ? M923: <u>Yes</u> During each transit of the M923 "up" the starboard aft quartering ramp, the driver "briefly" lost visibility of the ramp as the vehicle crested the highest point. Except for one instance (mentioned above) the M923 operator always had visibility of the ground guide.

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Event #	Event Description	Method	Data Evaluation
3.B 3.B(1)	Driver visibility on main vehicle deck (1) Suitability of driver visibility of Ground Guide.	(1) DC observation & Driver/Ground Guide survey	(1) Was any vehicle drivers visibility of the ground guide obstructed during transit over the main vehicle deck ? <u>No</u>
3.B(2)	(2) Suitability of driver visibility of main vehicle deck, bulkheads, and stanchions.	(2) DC observation & Driver/Ground Guide survey	(2) Was any vehicle drivers visibility of the main vehicle deck , bulkheads, and stanchions obstructed during transit? <u>No</u>
3.C 3.C(1)	Driver visibility on Mezzanine ramp (1) Suitability of driver visibility of Ground Guide	(1) DC observation & Driver/Ground Guide survey	(1) Was any vehicle drivers visibility of the ground guide obstructed during transit over the Mezzanine ramp ? <u>No</u>
3.C(2)	(2) Suitability of driver visibility of Mezzanine Ramp and curbs	(2) DC observation & Driver/Ground Guide survey	(2) Was any vehicle drivers visibility of the ramp and ramp sides obstructed during transit over the Mezzanine ramp ? <u>No</u>
3.D 3.D(1)	Driver visibility on Mezzanine deck (1) Suitability of driver visibility of Ground Guide	(1) DC observation & Driver/Ground Guide survey	(1) Was any vehicle drivers visibility of the ground guide obstructed during transit over the Mezzanine deck ? <u>No</u>
3.D(2)	(2) Suitability of driver visibility of deck & bulkheads	(2) DC observation & Driver/Ground Guide survey	(2) Was any vehicle drivers visibility of the Mezzanine deck & bulkhead obstructed during transit? <u>No</u>

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Event #	Event Description	Method	Data Evaluation
3.E 3.E(1)	Driver visibility on Hoistable ramp (1) Suitability of driver visibility of Ground Guide	(1) DC observation & Driver/Ground Guide survey	(1) Was any vehicle drivers visibility of the ground guide obstructed during transit over the Hoistable ramp? Unk <i>*Note. Prior to commencing the LOE, INCAT engineers determined that the Hoistable Ramp <u>did not</u> have the required deck strength to support any test vehicles. Therefore, the ramp was excluded form all testing.</i>
3.E(2)	(2) Suitability of driver visibility of deck & bulkheads	(2) DC observation & Driver/Ground Guide survey	(2) Was any vehicle drivers visibility of the deck and sides obstructed during transit over the Hoistable ramp? Unk <i>*Note. Prior to commencing the LOE, INCAT engineers determined that the Hoistable Ramp <u>did not</u> have the required deck strength to support any test vehicles. Therefore, the ramp was excluded form all testing.</i>
3.F 3.F(1)	Driver ability to hear ground guides. (1) Adequacy of drivers hearing aboard HSV.	(1) DC observation & Driver/Ground Guide survey	(1) Was the driver able to hear ground guide commands during transit through the ship? No: Verbal communication between operators and ground guides was NOT possible unless the vehicle was stopped and the guide approached the operators window and passed instruction face-to-face. A distinct and definitive set of "hand-and-arm" signals was required for adequate communication.
3.G 3.G(1)	Ventilation on main vehicle deck (1) Adequacy of exhaust ventilation on all vehicle stowage decks	(1) DC observation & Driver/Ground Guide survey	(1) Was there a noticeable build-up or accumulation of exhaust fumes during vehicle maneuverability events? Unk: There were brief moments during the LOE when multiple vehicles were operating in the main deck that fumes were noticed, but they quickly dissipated due to the vessels natural ventilation.

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Event #	Event Description	Method	Data Evaluation
3.H 3.H(1)	"Fire Lanes" on main vehicle deck (1) Adequacy of fire lanes around embarked equipment on main vehicle deck	(1) DC observation & SME survey	(1) Were fire lanes present and accessible around all staged vehicles on the main vehicle deck ? <u>Yes</u>
3.I 3.I(1)	"Fire Lanes" on Mezzanine ramp and deck (1) Adequacy of fire lanes around embarked vehicles on Mezzanine deck	(1) DC observation & SME survey	(1) Were fire lanes present and accessible around all staged vehicles on the Mezzanine ramps and deck ? <u>Yes</u>
3.J 3.J(1)	"Fire Lanes" on Hoistable ramp (1) Adequacy of fire lanes around embarked vehicles on Mezzanine deck	(1) DC observation & SME survey	(1) Were fire lanes present and accessible around all staged vehicles on the Hoistable ramp ? <u>Unk</u> <i>*Note. Prior to commencing the LOE, INCAT engineers determined that the Hoistable Ramp <u>did not</u> have the required deck strength to support any test vehicles. Therefore, the ramp was excluded form all testing.</i>
		Note..... All of the following assessment events for "Vehicle Embarkation Characteristics" will be reviewed during <u>LOE PHASE 3</u> (High-speed transit to BIC from MHCNC) during the week of 26-30 Nov 01.	
4.	Vessel Embarkation Characteristics A. Starboard-Aft Quartering Ramp B. Vehicle Stowage Areas C. Human Factors & Safety		

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Event #	Event Description	Method	Data Evaluation
4.A 4.A(1)	Starboard-Aft Quartering Ramp (1) Verify ramp "deck" strength	(1) Review Loading & Embarkation Characteristics	(1) PSF Rating: _____
4.B 4.B(1)	Vehicle Stowage Areas (1) Determine deck and "internal" ramp strengths	(1) Review Loading & Embarkation Characteristics	(1) PSF Rating: _____
4.B(2)	(2) Determine <u>SQFT & CUFT</u> in all vehicle stow areas	(2) Review Loading & Embarkation Characteristics	(2) SqFt: _____ CuFt: _____
4.B(3)	(3) Determine vessels "maximum" <u>payload capacity</u> by weight, sqft, cuft	(3) Review Loading & Embarkation Characteristics	(3) Max Payload: _____ STons
4.B(4)	(4) Determine effects of "combat loading" on payload capacity	(4) Review Loading & Embarkation Characteristics	(4) Is there a negative impact? Yes No Unk
4.C 4.C(1)	Human Factors & Safety (1) Determine adequacy of Fire Fighting & Safety Equipment placement / distribution	(1) SME's observe-verify	(1) Is Fire Fighting & Safety Equipment placement / distribution adequate? Yes No Unk
4.C(2)	(2) Determine "adequacy" of Berthing & Work spaces	(2) SME's observe-verify	(2) Are Berthing & Work spaces adequate? Yes No Unk
4.C(3)	(3) Determine "adequacy" of Sanitation Facilities (toilets, showers, trash)	(3) SME's observe-verify environmental control, HVAC, personal gear stowage, etc.,	(3) Are Sanitation Facilities adequate? Yes No Unk
4.C(4)	(4) Determine "adequacy" of Messing facilities	(4) SME's observe-verify	(4) Are Messing facilities adequate? Yes No Unk
4.C(5)	(5) Determine "adequacy" of crew training	(5) SME's observe-verify	(5) Is crew training adequate? Yes No Unk

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Event #	Event Description	Method	Data Evaluation
4.C(6)	(6) Determine adequacy of HAZMAT & Fuel stowage	(6) Ship Loading & Embarkation Characteristics	(6) Are HAZMAT & Fuel stowage adequate? Yes No Unk
4.C(7)	(7) Determine adequacy of the Medical "facility"	(7) SME's observe-verify	(7) Is the Medical "facility" adequate? Yes No Unk
4.C(8)	(8) Determine adequacy of "Safety Documentation" provided by the owner	(8) Review INCAT Safety Assessment Report	(8) Is the Safety Documentation adequate? Yes No Unk
4.C(9)	(9) Determine "adequacy" of protective measures against EM hazards to personnel, volatile fuels, and HazMat.	(9) Ship Loading & Embarkation Characteristics	(9) Are the protective measures against EM hazards to personnel, volatile fuels, and HazMat adequate? Yes No Unk
4.C(10)	(10) Verify that ship systems do not create adverse health environments for embarked personnel.	(10) Ship Loading & Embarkation Characteristics	(10) Do ship systems create any adverse health environments for embarked personnel.? Yes No Unk



**UNITED STATES MARINE CORPS
MARINE CORPS WARFIGHTING LABORATORY
MARINE CORPS COMBAT DEVELOPMENT COMMAND
QUANTICO, VIRGINIA 22134-5096**

IN REPLY REFER TO:

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CSS TECH/jbs
11 Dec 01

From: Combat Service Support Technology Project Officer
To: Head, Joint Operations Center, Marine Corps Combat Development Command

Via: (1) Head, Technology
(2) Chief of Staff
(3) Commanding General

Subj: JOINT VENTURE HSV-X1 LIMITED OBJECTIVE EXPERIMENT (LOE): QUICK
LOOK REPORT

1. The Joint Venture HSV-X1 LOE was conducted 27 – 29 November 2001 at the State Port of Embarkation, Morehead City, NC (SPOE MHC, NC) and Blount Island Command (BIC), Jacksonville, FL.

2. The Joint Venture HSV-X1 is an advanced hull propulsion technology with which the Marine Corps Warfighting Lab (MCWL) and other Service specific laboratories are conducting assessments of vessel capabilities, limitations, and “general” military utility for potential operational employment. The Australian shipbuilders, Incat Tasmania Pty Ltd, designed the vessel. To meet assessment requirements, the vessel underwent six (6) weeks of technical and structural modifications. The modifications included the building and installation of a helo-deck suitable for large military helicopters such as the SH-60 Seahawk and the CH-46 Sea Knight. A two-part hydraulically operated vehicle ramp that allows rapid loading and discharge of vehicles from either the stern or alongside was also designed and constructed as well as an internal refit to equip the Joint Venture for troop transportation.

Specific Marine Corps experimentation centers on the Joint High Speed Vessel’s (JHSV) capabilities within the context of Expeditionary Maneuver Warfare (EMW) and Network Centric Warfare (NCW). Efforts are focused to provide insights into JHSV impacts on future operational concepts throughout the deployment, employment, sustainment and redeployment cycle. Additionally, exploration into future JSHV tactics, techniques, procedures, and technologies (TTPT) and the complementary nature of the vessel with amphibious and Maritime Prepositioning Force (MPF) platforms will be conducted.

3. Purpose. The purpose of the LOE was to assess the Joint Venture HSV-X1 in regards to MPF interoperability in order to develop naval expeditionary concepts and capabilities for future Joint Force commanders. The following issues were addressed and became the focus for assessment:

v Compatibility with and allowance for onboard maneuverability of USMC vehicles and equipment. *If* provision is made for a main vehicle deck, *then* stowage areas will be compatible with vehicle and equipment types considered “essential” to MPF/MAGTF operations?

v High-speed/high payload performance with the advanced hull propulsion technology: *If* the vessel is provided with advanced hull propulsion technology, *then* the JHSV will have the mobility (draft, range, speed, fuel, and payload) required to support sea-borne operations within the context of Expeditionary Maneuver Warfare (EMW)?

v Effects the Joint Venture HSV-X1’s high-speed transit has on embarked personnel and equipment: *If* the vessel is capable of embarking service personnel, *then* it will provide for all the safety, health, and habitability requirements necessary for embarked troops?

v Joint Venture HSV-X1 capability of conducting military type operations in a major USMC Port of Embarkation (POE) whether established or austere: *If* the vessel is provided with a starboard-aft, quartering ramp sufficient to support roll-on/roll-off RO/RO evolutions, *then* the vessel can conduct self-sustained and simultaneous offload operations in support sea-borne operations within the context of Expeditionary Maneuver Warfare (EMW)?

4. Results. Although assessment during the LOE was thorough, not all evolutions were completed, successfully. Location of the starboard-aft quartering ramp limits maneuverability of larger vehicles within the USMC inventory (i.e. MK-4815 w/M-870A1 trailer [Logistics Vehicle System – LVS]). This became evident when the LVS was “backed” into the vessel (to simulate combat loading). The power unit, fifth wheel, and trailer were required to back into the port side vehicle lane, only. This was a result of various ISO containers and personally owned vehicles (ships company) being staged for transportation/transit in the center of the three (3) vehicle lanes. With the starboard side lane at too severe an angle for traverse by the LVS and the center lane blocked, the only stowage area was to the port side. The vehicle was embarked aboard ship, to such an extent that its three (3) articulating points prevented access into the identified vehicle lane. Therefore, the vehicle remained in a position just forward of the ramp area blocking access to all other stowage areas. The LVS also scraped the driver side, brush guard with the starboard aft bulkhead of JHSV due to articulation within vehicle deck.

Note: Future JHSV’s need to consider ramp location and ability to RO/RO sufficiently to accommodate USMC material and equipment as a Key Performance Parameter for source selection and development.

See also the table, following. This table displays the events by type, and shows the number of times that objective was either met, met “with exception”, or not met. Comments amplifying certain events are provided.

5. Event Matrix

EVENT DESCRIPTION	MET	MET W/EXC	NOT MET	COMMENTS
1. Vehicle Maneuverability				A. Starboard Aft Quartering Ramp B. Main Vehicle Deck
1.A Starboard Aft Quartering Ramp	X			<p>1.A (1) The following vehicles were successful in maneuvering through the designated areas:</p> <ul style="list-style-type: none"> -AAV -LAV-25 -M998 (highback) / M116 trlr -M929 Dump /M353 trlr -LVS Mk48/16/870: The LVS was evaluated in two "onload" scenarios in order to evaluate the M870's compatibility with the ramp <p>(a) The LVS drove forward up the ramp to load the HSV: (b) The LVS backed up the ramp in order to load the HSV:</p> <p>The M870 trailer has three rows of parallel rear axles. In both scenarios, the two "inboard" axles of the trailer lost contact while traversing the stern ramp's "knuckles". Had the trailer been transporting cargo, the entire weight of that cargo would have been supported by a <u>single</u> trailer axle. Damage could have resulted if the axle's capacity was exceeded by the cargo's weight. Had the ramp been completely straight this problem would not be an issue.</p> <p>1.A (2) No test vehicles failed to navigate this area.</p>
1.B. Main Vehicle Deck		X		<p>1.B (1) The following vehicles were successful in maneuvering through the designated area:</p> <ul style="list-style-type: none"> -AAV -LAV-25 -M998 (highback) / M116 trlr -M929 Dump /M353 trlr: 3-point turn <p>1.B (2) The following vehicles were NOT successful maneuvering through the designated area:</p> <ul style="list-style-type: none"> -LVS Mk48/16/870: This LVS variant was evaluated in two "onload" scenarios: <p>(a) The LVS drove forward up the ramp to load. (b) The LVS backed up the ramp in order to load.</p> <p>(a) The LVS drove forward aboard the HSV in an attempt to stage the entire vehicle in a designated spot amidships. While loading in this manner the LVS was able to transit the starboard-aft quartering ramp but its length was too great to maneuver into a stowage location. The LVS was then successfully "backed" down the ramp and off the vessel.</p> <p>(b) The LVS successfully backed aboard the HSV. While loading in this manner the vehicle transited the starboard-aft quartering ramp and successfully maneuvered the entire LVS configuration onto the main vehicle deck. However the LVS could NOT maneuver the 870 trailer into the designated "port side" deck spot. The LVS length forced the vehicle to straddle the aft access lanes and subsequently block accessibility from the ramp to the main vehicle deck.</p> <p>Note: SME's advise that an <u>experienced</u> operator and ground guide team <u>could</u> stage the M870 trailer into the designated deck spots. This event will be re-evaluated during a later LOE.</p>

EVENT DESCRIPTION	MET	MET W/EXC	NOT MET	COMMENTS
2. Self-sustained Offload				2. A. Austere Port. Definition: Waterside platform / structure with sufficient stability to support RO/RO and / or LO/LO "offload" operations. Austere ports <u>can</u> provide mooring cleats, minimal water depth, and unimproved vehicle "exit routes". Any additional capabilities would de-classify the platform / structure as "austere". No pierside support / sustainment services should be available (i.e. personnel, equipment, etc.).
2.A. Austere Port		X		2.A (1) The JHSV moored at Berth-3, Blount Island Command (BIC) 2.A (2) Berth-3 description: - mooring cleats were available, - sufficient depth was available, - exit routes were available, - berth was confined by other concrete abutments and another moored ship - area available for pierside deployment of the starboard-aft quartering ramp was small and obstructed by numerous ISO containers - fendering <u>was</u> provided pierside by BIC 2.A (3) Berth-3 did <u>not</u> qualify as an "austere" facility due to provision of "fendering". 2.A (4) JHSV was "highly" successfully in executing a "self-sustained" offload of eight (8) AAV's transferred from the SS Pless at Morehead City, NC. *Note: With the exception of fendering, Berth-3 was an <u>exceptional</u> example of an "austere" port. The maneuverability of the JHSV into a confined berth, restricted by concrete abutments and other shipping was an outstanding display of the vessels capabilities.
3. Operational Mobility				A. Draft B. Range C. Sustained Speed D. Fuel Status E. Payload / Displacement F. Loitering (Payload, Time, Speed)
3.A. Draft	X			3.A (1) <u>12.5 Ft</u> (No Embarked Payload) 3.A (2) <u>13.2 Ft</u> (23.7 STons Payload)
3.B. Range (POE - to - POD)	X			3.B (1) 375 NM (Morehead City, NC - Naval Station Mayport, FL)
3.C. Speed: (Max -Sustained)	X			3.C (1) 39 Knots Max Speed from POE - to - POD 3.C (2) 31 Knots Avg Sustained Speed
3.D. Fuel Status	TBD	TBD	TBD	3.D (1) Initial Qty: 103,000 Gals (95% capacity) 3.D (2) Final Qty: <u>TBD</u> Gals
3.E. Payload / Displacement	X			3.E (1) <u>190 STons</u> (23.7 STons per AAV) 3.E (2) <u>1,869 STon</u> Displacement
3.F. Loitering	TBD	TBD	TBD	3.F (1) Payload: 190 STons (23.7 STons per AAV) 3.F (2) Time: <u>TBD</u> Hours / Minutes (Transit St. Johns River) 3.F (3) Speed: 9 Knots Avg

EVENT DESCRIPTION	MET	MET W/EXC	NOT MET	COMMENTS
4. Effects of high-speed transit				A. Personnel B. Equipment
4.A. Personnel	NA	NA	NA	4.A (1) The 12-hour transit time from Morehead City, NC to NAS Mayport, FL and subsequently BIC (Jacksonville, FL) was too short in duration to accurately reflect any negative effects on embarked personnel.
4.B. Equipment	NA	NA	NA	4.B (1) The 12-hour transit time from Morehead City, NC to NAS Mayport, FL and subsequently BIC (Jacksonville, FL) was too short in duration to accurately reflect any negative effects on equipment.
5. Safety, Health Habitability of embarked PAX				A. Ventilation
5.A. Ventilation			X	5.A (1) During slow speed transit (5-10 knots) the JHSV continuously discharged an enormous amount of exhaust. These fumes accumulated within the main vehicle deck, preventing crewmen from preparing vehicles for offload. The amount of exhaust discharged by the JHSV engines was determined to be unsafe and hazardous for prolonged exposure.

6. Observations

a. Vehicle maneuverability and compatibility. Although the following are the only vehicles assessed during this LOE, two (2) previous events conducted at Naval Amphibious Base, Little Creek, VA assessed other type items within the USMC inventory¹.

Vehicle Type	DTG Onload	Pass/Fail	Comments
MK4815 w/M870A1 trailer	281100R Nov 01 281131R Nov 01	Fail	1. Details aforementioned in paragraph 4. 2. Two (2) attempts made (forward/backward). 3. Third axle on trailer was only axle remaining on the deck, as entire vehicle was moving across ramp. 4. Vehicle was able to navigate ramp.
LAV-25	281119R Nov 01	Pass	N/A
M-817 Dump Truck w/M-353 trailer	281150R Nov 01	Pass	1. Dump empty & trailer w/o attachments.
M-998 HMMWV (high-back) w/M-353 trailer	281158R Nov 01	Pass	1. Trailer empty.
Assault Amphibian Vehicle (AAVP-7A1)	281405R Nov 01	Pass	1.Total of eight (8) embarked for high-speed transit to BIC.

b. USMC POE compatibility. Joint Venture HSV-X1 was able to berth starboard side at berth eight, SPOE MHC, NC without difficulty. Berth length is 550 feet with an apron width in excess of 100 feet. Depth of the water is 35 feet at Mean Low Water (MLW) with a pier height of 10 feet at MLW. Atop the concrete pier is an eight (8) inch wooden curb. 20 inch steel

¹ Previous successful vehicle assessments included: AAV, M-998 HMMWV (lowback), M-923, M-923 w/ M-353 trailer (welding unit attached), Improved Fast Attack Vehicle (IFAV), Forklift (Extended Boom Forklift [EBFL][USMC], ATLAS [USA EBFL equivalent] and RT-4000). Previous unsuccessful vehicle assessments included: M-916 w/M-870A1 trailer and M-915A2 w/M-872 flatbed trailer.

mooring cleats are distributed along the wooden curbing. Overhead cranes travel the length of all berths.

Tidal data for 28 Nov 01 was as follows:

(1) High: 0514 and 1715

(2) Low: 1135 and 1123

Currents in the area are at two (2) – three (3) knots.

Vessel draft prior to onload of equipment at SPOE MHC, NC was at 3.85 meters/12.5 feet. This included all vessel liquid weight and those personnel and equipment already embarked from NAB Little Creek, VA. Vessel draft post onload and prior to movement to Mayport, FL was 4.05 meters/13.2 feet.

c. Austere port compatibility. Joint Venture HSV-X1 was able to berth starboard side, angled with two points fendered alongside vessel at berth three, BIC. Fendering was provided by BIC and not by the JHSV thus negating true, self-sustaining offload in an austere environment. The opinion of subject matter experts is that had organic fendering been available, Joint Venture HSV-X1 would have met self-sustaining offload requirements at austere port without exception. Lines were heaved and secured to various bollards and mooring cleats within the area in a non-standard fashion².

Note: Joint Venture HSV-X1 handling by ship's Captain and crew was above reproach during this restricted maneuvering evolution. Starboard side, water jet guard was to within less than a foot of impacting cement seawall during mooring as vessel positioned itself for offload.

The starboard aft, quartering ramp was set in place among ISO containers, emplaced for force protection, in preparation for the AAV offload. Ramp edge settled into sand and offload commenced at 1630 on 29 Nov 01. Total offload time was 16 minutes, 14 seconds. Mooring to an austere site combined with AAV offload presented no problem to the JHSV aside from the destruction of numerous tie-down cleats within vehicle deck area. Cleat destruction was as a result of AAV traverse over tie-down cleats.

d. Vessel Transit. The Joint Venture HSV-X1 was underway from SPOE MHC, NC at 2000 on 28 Nov 01 enroute to Mayport, FL for AAV crew pickup and further transit to BIC. Vessel displacement at the underway time was approximately 1,869 short tons that accounted for all liquid weight, eight (8) AAV's, and all other embarked crew and equipment. Transit time was from 2000 on 28 Nov 01 until approximately 0800 on 29 Nov 01. Average transit speed was at 29 – 32 knots throughout the duration with a maximum speed of 39 knots for 30 minutes attained.

² For purposes of the quicklook, "non-standard" is referred to mooring to an area not developed to accommodate vessel of Joint Venture size and not normally used as a berthing area.

Note: Transit duration was insufficient in length to adequately and properly assess motion effects on personnel.

Note: Vehicle deck consumed in vessel/engine exhaust and ocean spray during transit providing nauseating and slippery environment, unsafe for occupation during movement.

7. Recommendations

- a. Future JHSV's be equipped with stern ramp with capability to traverse port-to-starboard in order to accommodate alongside marriages of naval causeways and berths of varying types for facilitating RO/RO of inventory of essential USMC vehicles and equipment. Ramps need to be absent of any flexible joints causing "knuckles" or sags resulting in vehicles to "bottoming-out".
- b. Future JHSV vehicle tie-downs (four-point) constructed of material stronger than currently used and able to accommodate the securing of essential USMC vehicles and equipment.
- c. Future JHSV's equipped with non-skid surfaces on their vehicle decks.
- d. Future JHSV's equipped with appropriate ventilation equipment for clean air purposes during high-speed transit and loitering speeds. "Redirection" of exhaust away from stowage areas is possible solution.
- e. Future JHSV's Internal ramps and mezzanine decks need increased clearances for vehicle stowage.
- f. Future JHSV's provided with capability to enclose vehicle deck, completely, to prevent weather damage in extreme environments.
- g. Future JHSV's supplied with organic fendering to enhance self-sustained offload capabilities at either established or austere port facilities.
- h. Future JHSV's supplied with organic Material Handling Equipment (MHE).

J. B. STONE IV
Capt USMC

Bulk Fuel Company, 2nd Engineer Support Battalion LOE



Quicklook Report

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7 February 2002



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IN REPLY REFER TO:
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FEB 07 2002

From: Commanding General

Subj: BULK FUEL COMPANY, 2nd ENGINEER SUPPORT BATTALION LOE

Encl: (1) Bulk Fuel Company, 2nd Engineer Support Battalion
LOE

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WILLIAM D. CATTO

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Bulk Fuel Company, 2nd Engineer Support Battalion LOE

On 10 January 2002, *Joint Venture* (HSV-X1) transported the Bulk Fuel Company, 2nd Engineer Support Battalion, 2nd FSSG from Morehead City, North Carolina to NAB Little Creek, Virginia. This intra-theater move was a lift of opportunity for the Bulk Fuel Company on its way to a training event (exercise Winter Blaze) at Fort Eustis, Virginia. It also provided another data collection event for the Marine Corps experimentation with this vessel and was developed into a Limited Objective Experiment (LOE).

Joint Venture is a 96-meter (313 foot) commercial catamaran car ferry chartered from Bollinger/Incat USA capable of sustained speeds in excess of 40 knots. This experimental Joint High Speed Vessel (JHSV) has been chartered by component commands from the Army, Navy, Marine Corps, Special Operations Command, and Coast Guard for a 12-month project to explore the operational implications of new marine technologies. *Joint Venture* has undergone modifications to enhance its military utility. These include:

- Ability to launch/recovery small boats
- A stern quartering ramp was added to for self-sustaining vehicle offload
- A flight deck was added to allow day/VFR flight operations with aircraft of CH-46 and smaller size
- A limited C4I capability was added.

Objectives

The LOE was planned with three major objectives and their associated hypotheses. These included:

- Onboard compatibility of USMC vehicles and bulk cargo. If the vessel has a main vehicle ramp and deck, then transit and storage areas will be interoperable with USMC vehicles and bulk cargo.
- High-speed/high-payload performance. If the vessel is provided with advanced hull propulsion technology, then it will have the mobility, operational reach, and tactical flexibility (draft, range, speed, fuel, and payload capability) required to support sea-borne operations within the context of Expeditionary Maneuver Warfare.
- High-speed transit effects on personnel and equipment. If the vessel is capable of embarking service personnel and equipment:
 - Then it will provide for all the safety, health, and habitability requirements necessary for embarked troops.
 - Then it will provide the appropriate stowage environment for all operational climates.
 - Then the effects of high/low speed transit will not degrade the performance capabilities of the embarked personnel and equipment.

Joint Venture LOE Load out

Table 1 describes the personnel embarked on the vessel during the LOE. The crew of 49 includes 15 Army personnel, who were onboard as preparation for their taking over operation of the vessel in March, as per the JHSV Joint service Memorandum of Agreement (MOA). MCCSSS students were embarked to provide them an opportunity to see a potential future Marine Corps capability.

Table 1. *Joint Venture* LOE personnel load out

	Number
Crew (USN + USA)	49
Bulk Fuel Company	159
MCWL and ONR riders	8
MCCSSS	13
Total	229

Table 2 describes the cargo embarked by the *Joint Venture* during the LOE. It equates 421,102 pounds of cargo. Three TRAMs (tractor, rubber-tired, articulated steering, multi-purpose) and a RT-4000 forklift were used to load the 96 individual break bulk items in Morehead City. No more than three were operating at any one time. Two TRAMS were used to offload the cargo at NAB Little Creek.

Table 2. *Joint Venture* LOE equipment load out

Equipment	Number	Equipment	Number
5-ton (long-bed) + trailer	2/2	Pump units	12
HMMWV	5	Hose units	3
TRAM	1	Storage tank assembly	36
EBFL	1	Beach unload assembly	4
		Light sets	5
		PALCON	15
		QUADCON	4
		Other break bulk items	17

Event Timeline

Table 3 describes the planned and actual time-lines for the movement of the Bulk Fuel Company from Morehead City to NAB Little Creek. The vessel departed NAB Little Creek around midnight with a full load of fuel (in both long-range and day tanks), but no cargo. The vessel arrived in Morehead City 3 ½ hours late because of a storm it encountered on the trip from NAB Little Creek. This, plus delays in loading the break bulk cargo, caused the vessel to leave seven hours later than planned. During the loading, a 600 GPM pump and M149 Waterbull were damaged. During the transit to NAB Little Creek, the *Joint Venture* suffered an engineering casualty. The port outer engine had an exhaust leak, which decreased the vessel's maximum speed. This delayed the arrival of the *Joint Venture* to the morning of 11 January.

Table 3. LOE Timeline (10 –11 January).

Event	Planned time	Actual time
JHSV ramp down	0700 10 Jan	1116 10 Jan
Passenger load start	0700 10 Jan	1156 10 Jan
Vehicle/cargo load start	0800 10 Jan	1156 10 Jan
Vehicle/cargo load end	1000 10 Jan	1610 10 Jan
JHSV underway Morehead City	1100 10 Jan	1815 10 Jan
JHSV arrive NAB Little Creek	1800 10 Jan	0600 11 Jan
Start offload	1800 10 Jan	0640 11 Jan
Offload finished	1900 10 Jan	1400 11 Jan

Data on vessel operational characteristics and sea states during both transits was collected by Naval Surface Warfare Center, Carderock Division. On the transit south, 8-10 foot seas and winds of 25 to 30 knots were observed. These steep seas produced a very rough ride, causing a high incidence of seasickness among the crew and a great deal of center bow and aft wet deck slamming. The waves were steep enough at times to induce "double slamming." Speed (between 20 to 32 knots) and heading (head sea 20 to 60 degrees off the bow) were varied in an attempt to reduce slamming. The ride improved at speeds greater than 30 knots, but when slamming occurred, it was much more violent than at lower speeds. A structural inspection of the vessel upon arrival in Morehead City discovered damage in the bow of the ship.

Based on draft mark readings, the ship displacement for the return trip was about 1650 to 1700 metric tons. All Bulk Fuel Company Marines took seasickness medication prior to vessel departure. Seven reported nausea and vomiting during the transit.

Offload of the vessel was slowed by a number of things. First, there were only two TRAMS available to offload the vessel at NAB Little Creek. Second, the Bulk Fuel Company's equipment assembly area was farther from the vessel, than it was in Morehead City. This led to longer transit times for the MHE offloading the vessel.

Observations

In general, this LOE looked at the use of the JHSV to move a unit intra-theater, with vehicles and break bulk cargo. The unit was not tactically/combat loaded. During this LOE, we observed that break bulk cargo operations in this type of vessel are slow because it has only one means of access to the vehicle deck (stern quartering ramp).

This LOE included a number of firsts during Marine Corps JHSV experimentation:

- Embarkation of long-bed 5-tons (M927) with trailers
- Embarkation of break bulk cargo
- Largest passenger lift of Marine personnel for an extended voyage to date
- TRAM used to load and offload.

The rest of this section consolidates the observations of all the MCWL observers during the LOE. Because of time constraints, observation of the complete offload at NAB Little Creek was not possible.

If the vessel has a main vehicle ramp and deck, then transit and storage areas will be interoperable with USMC vehicles and bulk cargo?

- Enclose the open vehicle deck to decrease damaging effects of salt-water spray on embarked cargo.
- The movable vehicle deck cannot support the weight of ground tactical vehicles. Recommend removing it in order to open up the vehicle deck or find a use for its limited weight capacity.
- Stanchions supporting the vehicle deck restricted M927 on-load and TRAM operations to load break bulk. A more open vehicle deck is desirable.
- Need to containerize break bulk cargo to the greatest extent possible in order to minimize cargo lifts and decrease vessel on-/off-load times
- M927 with trailer required 3- and 5- point turns in order to maneuver inside the vehicle deck.
- Ship's crew added a wooden insert to the stern quartering ramp in order to reduce the likelihood of trailers bottoming out during onload/offload.
- Stern quartering ramp needs to be wider to accommodate larger vehicle or cargo. In this evolution, ramp support cables obstructed loading of wide break bulk items.
- Palletized loads carried by MHE (especially loads carried by the RT-4000) up the ramp were made unstable by the joints of the folding ramp. A straight ramp would eliminate this problem.

- Vessel configuration supported backing TRAM off the vessel after loading bulk items.

If the vessel is provided with advanced hull propulsion technology, then it will have the mobility, operational reach, and tactical flexibility (draft, range, speed, fuel, and payload capability) required to support sea-borne operations within the context of Expeditionary Maneuver Warfare

- Vessel needs to carry its own fenders and MHE to allow for self-sustaining operations in austere ports.
- Vessel sustained an engineering casualty (port outer engine had an exhaust leak) during the transit from Morehead City to NAB Little Creek, which reduced the transit speed.

High-speed transit effects on personnel and equipment

Joint Venture transited both to and from Morehead City in bad weather. To summarize, the ride is very much like that of an intercontinental airplane trip, with the lateral motion of a LST.

Vessel safety, health, and habitability requirements for embarked troops

- Vessel had two different evolutions going on at the same time (vehicle loading and moving containers), which could have led to a safety problem.
- Sanitation facilities were inadequate for this large a passenger lift, sitting in port for an extended time period.
- Need to ensure there is adequate ventilation (heating and cooling) for all shipboard areas that embarked Marines will encounter.
- Need a capability to provide hot chow to embarked Marines during a long transit.
- Embarked passenger seats need to be modified on order to reduce effects of seasickness.
- Many Marines slept on the floor during the trip to NAB Little Creek. Additional legroom in the seats might help.
- Increase personnel gear storage in the seating areas.
- In the passenger compartment, the Media system is wired for all or none. Need to be able to control by seating section.

Vessel stowage environment for all operational climates

- Weapon storage needs to be provided for embarked Marines.
- For this evolution, Marine personnel gear (packs) was stored under canvas on an exposed vehicle ramp. After the transit, the packs were wet. Need to provide accessible storage space for embarked Marines.

Effects of high/low speed transit on performance capabilities of the embarked personnel and equipment

- Combat effectiveness of Marines at the end of a high-speed, long-range transit may be diminished. Need to do further detailed research in this area.

Battle Griffin 02

Limited Objective Experiment



Quicklook Report

Capt James Stone
Robert Bickel
John Goetke

10 April 2002



UNITED STATES MARINE CORPS
MARINE CORPS WARFIGHTING LABORATORY
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MAY 06 2002

To: File

From: Commanding General

Subj: Battle Griffin 02 Limited Objective Experiment
Quicklook Report

Encl: (1) Battle Griffin 02 Limited Objective Experiment
Quicklook Report

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WILLIAM D. CATTO

Introduction

Since June 2001, planning has been on going for the employment of the *Joint Venture* (HSV-X1) in the II MEF Exercise Battle Griffin 02. It was determined that this exercise provided an excellent opportunity to explore the operational and tactical employment of a high speed vessel (HSV) in direct support of a Marine Air-Ground Task Force (MAGTF) operating in a littoral environment.

Joint Venture is a 96-meter (313 foot) commercial catamaran car ferry chartered from Bollinger/Incat USA capable of sustained speeds in excess of 40 knots. This experimental Joint High Speed Vessel (JHSV) has been chartered by component commands from the Army, Navy, Marine Corps, Special Operations Command, and Coast Guard for a 12-month project to assess the vessel's capabilities and limitations to determine its "general" military utility for potential operational and tactical employment.

Joint Venture has undergone modifications to enhance its military utility. These include:

- Ability to launch/recovery small boats
- A stern quartering ramp was added for independent vehicle offload
- A flight deck was added to allow day/VFR flight operations with CH-46 and SH-60 aircraft
- A limited command, control, communications, computers, and intelligence (C4I) capability was added.

Marine Corps experimentation with the JHSV centers on its capabilities within the context of Expeditionary Maneuver Warfare. Efforts are focused to determine what impacts the JHSV has on future operational concepts throughout the deployment, employment, sustainment and redeployment cycle. Additionally, exploration into future JSHV tactics, techniques, procedures, and technologies (TTPT) and the complementary nature of the vessel with amphibious and maritime prepositioning ships will be conducted.

Objectives

JHSV was employed in Battle Griffin 02 to assess the role of high-speed vessels in operational maneuver during MAGTF operations in a littoral environment. Potential missions the vessel was expected to perform included:

- Inter-/intra-theater cargo lift
- Insertion/extraction of Reconnaissance, Surveillance, and Target Acquisition (RSTA) elements
- Raids
- Sea-borne envelopment of opposing forces
- Medical evacuation (MEDEVAC)
- Command and control (C2) of landward and seaward forces.

The Limited Objective Experiment (LOE) was planned with three major objectives and their associated hypotheses. These included:

- JHSV role in operational maneuver during MAGTF operations in a littoral environment
 - Onboard compatibility of USMC vehicles and bulk cargo. If the vessel has a main vehicle ramp and deck, then transit and storage areas will be interoperable with USMC vehicles and bulk cargo.
 - High-speed/high-payload performance. If the vessel is provided with advanced hull propulsion technology, then it will have the mobility, operational reach, and tactical flexibility (draft, range, speed, fuel, and payload capability) required to support sea-borne operations within the context of Expeditionary Maneuver Warfare.
 - Onboard compatibility of USMC helicopters. If the vessel has a certified helicopter flight deck, then it will be compatible with the essential USMC rotary-winged aircraft.
 - Command and Control. If the vessel is provided with a modular C4I infrastructure, then it will provide all the appropriate command and control in support of MAGTF employment.
 - Bilateral interoperability. If the JHSV conducts evolutions in conjunction with foreign nations, then such combined evolutions will not have a degrading effect on the vessel's performance and/or capabilities.
- High-speed transit effects on personnel and equipment. If the vessel is capable of embarking service personnel and equipment:
 - Then it will provide for all the safety, health, and habitability requirements necessary for embarked troops.
 - Then it will provide the appropriate stowage environment for all operational climates.
 - Then the effects of high/low speed transit will not degrade the performance capabilities of the embarked personnel and equipment.
- Extreme environment. If the JHSV conducts operations in extreme environments, to include adverse weather and sea-state:
 - Then the vessel's performance and capabilities will not be degraded.
 - Then performance and capabilities of the embarked personnel and equipment will not be degraded.

Experiment organization

The experiment plan consisted of five phases:

- *SPOE Morehead City North Carolina Onload* (4-5 February 2002): This phase began with the loading of selected USMC equipment and bulk cargo on the JHSV in Morehead City for transit to the geo-prepositioned equipment sites in Norway. The phase concluded with the cargo loaded and prepared for transit.

- *Rota, Spain, Port Visit* (12-13 February 2002): This phase began with the arrival of the *Joint Venture* to the Rota, Spain naval facilities. A maintenance, inspection, and refueling period was the focus of this visit. Also, a detachment from Marine Corps Security Company Europe was embarked to augment vessel force protection. This phase concluded with the vessel's departure for Hommelvik, Norway. ***This was a non-observed LOE event.***¹
- *Hommelvik, Norway Offload* (16 February 2002): The phase began with the arrival of *Joint Venture* in Hommelvik to offload the geo-prepositioned equipment loaded during Phase I. This phase concluded with the vessel's departure from Hommelvik. ***This was a non-observed LOE event.***
- *Larvik to Hommelvik, Norway Shuttle* (19-22 February 200): This phase began when *Joint Venture* arrived in Larvik, Norway. During this phase, the JHSV made a round trip to shuttle Marine personnel and equipment from the *USS Tortuga* (LSD 46) anchored in Larvik to Hommelvik. This phase concluded with the offload of the Marine personnel and equipment in Hommelvik. At this point, Navy specific experimentation began. ***This was a non-observed LOE event.***
- *Tactical Field Training Exercise (FTX)* (8-15 March 2002): This phase began with the *Joint Venture* in direct support of the Commanding Officer, MAGTF 2 for use in the tactical "free-play" of Battle Griffin 02. Tactical evolutions the JHSV was prepared to support included, but were not limited to:
 - Amphibious raids and assaults (sea-borne envelopment)
 - Tactical insertion / extraction of RSTA assets
 - Medical evacuation
 - Retrograde of personnel and equipment
 - Re-supply of RSTA or maneuver forces ashore
 - Command and control of forces ashore.

This phase concluded at the end of the tactical exercise.

¹ While MCWL personnel did not physically observe certain phases, data was captured by JHSV crewmembers for inclusion within this report.

Phase I: SPOE Morehead City North Carolina Onload

On 4 February, *Joint Venture* was scheduled to pull into Morehead City, North Carolina. The vessel was to offload the Bulk Fuel Company, 2nd Engineer Support Battalion (ESB), 2nd FSSG it transported from NAB Little Creek, Virginia and load equipment it was to transport to Norway on its way to support Battle Griffin 02. This inter-theater move was a “lift of opportunity” for Blount Island Command to rotate equipment between CONUS and the Norway GeoPrepositioning sites.

Phase I load out

Table 1 describes the Bulk Fuel Company cargo offloaded by the *Joint Venture* in Morehead City. It equates to 421,102 pounds of cargo. It was off-loaded by one TRAM (tractor, rubber-tired, articulated steering, multi-purpose), two RT-4000 forklifts, and the ship’s organic 6000 lb. forklift. For this LOE, the ship was able to rent a 6000 lb. forklift for its own use.

Table 1. Bulk Fuel Company cargo offloaded

Equipment	Number	Equipment	Number
5-ton (long-bed) + trailer	2+2	Pump units	12
HMMWV	5	Hose units	3
TRAM	1	Storage tank assembly	36
EBFL	1	Beach unload assembly	4
		Light sets	5
		PALCON	15
		QUADCON	4
		Other break bulk items	17

Table 2 describes the cargo embarked on the *Joint Venture* for the trans-Atlantic trip. The eleven M198 155mm towed howitzers were destined for the Norway GeoPrepositioning site. They were loaded using two RT-4000 forklifts.

Table 2. *Joint Venture* inter-theater lift load

Equipment	Number
M198	11
Ship's 6000 lb forklift	1
Total items	12

Table 3 describes the personnel embarked on the vessel for the trans-Atlantic crossing. The crew was joined by 16 personnel from Incat, the Office of Naval Research, and the Naval Warfare Development Center.

Table 3. Embarked personnel for Atlantic crossing

	Number
Crew	31
Tech reps/others	16
Total	47

Phase I Timeline

Table 4 describes the time-line for the Bulk Fuel Company offload and onload of the Norway GeoPrepositioning equipment as it occurred on 6 February. The *Joint Venture* was originally scheduled to arrive in Morehead City late on 4 February, but was delayed until late on 5 February.

Table 4. Phase I timeline (5-6 February)

Event	Time (local)
JHSV arrives Morehead City	2300 5 Feb
Start ESB offload	0000 6 Feb
End ESB offload	0237 6 Feb
Start M198 onload	0315 6 Feb
End M198 onload	0530 6 Feb
JHSV departs Morehead City	1305 6 Feb

The Bulk Fuel Company equipment was off-loaded by one TRAM, two RT-4000 forklifts, and the ship's organic forklift. It was completed in 2 hours, 37 minutes. After a break for the ship's crew, the M198s were loaded in two hours and 15 minutes using the two RT-4000 forklifts to pull or push the M198s into the vessel. The vessel's departure for Rota was delayed while waiting to be refueled.

Observations

Observations from this phase of the LOE deal with only one of the LOE's objectives. It is the opinion of the analysis team that the only way to combat load a 5-ton pulling a M198 is to back them into the vessel. Due to space restrictions on the vehicle deck, there is no way to drive on and rearrange the load in a timely manner so it could be driven off.

Onboard compatibility of USMC vehicles and bulk cargo

- Evolution was enhanced by high tide conditions at the time of the offload/onload. This created a straight stern quartering ramp, eliminating the joints in the ramp that made loading the Bulk Fuel Company's palletized loads unstable.
- Vessel's crew modified the extensions of the stern quartering ramp, which improved the rolling stocks accessibility to the vehicle deck.
- There were no height clearance issues with loading M198s. Because of the vehicle deck support stanchions, the howitzers must be loaded facing fore or aft.
- M198s were loaded using two methods. First was to use a RT-4000 to pull the gun into the vessel, the other was to push the gun in using a RT-4000. Pushing was more efficient.
- When not married to a prime mover, the M198's towing point requires dunnage to eliminate a metal-on-metal storage situation.
- There was an issue regarding the width of the ramp support cables obstructing the offload of fuel hose boxes.
- Also, the hump/knuckle in the ramp created situations where the top pallet of double-stacked pallets on MHE nearly toppled due to severe motions caused by transiting the ramp knuckles.

Phase II: Rota Spain Port Visit

The *Joint Venture* stopped in Rota, Spain for refueling and required maintenance. The vessel also embarked 20 Marines from 1st Squad, 2nd Platoon, Marine Corps Security Company Europe to help provide force protection during the exercise. Table 5 shows when the vessel left the United States and length of the Rota port visit. No major repair work on the vessel was required.

Table 5. Phase II timeline (12-13 February)

Event	Time (Zulu)
JHSV departs Morehead City	0805 6 Feb
JHSV arrives Rota	1000 12 Feb
JHSV departs Rota	0700 13 Feb

Phase III: Hommelvik Offload

Phase III of the LOE was to start with the arrival of the *Joint Venture* in Hommelvik to offload the eleven M198s for geo-prepositioned site storage. This plan was changed when, because of weather concerns, the vessel went to Larvik, Norway to offload the howitzers. They were then moved to the storage sites by Norwegian Army trucks.

Phase III timeline

Table 6 shows when the vessel left Rota, Spain and the length of time it spent in Larvik, Norway. Offloading the eleven M198s took 1 hour and 40 minutes. The *Joint Venture* then had to wait in Larvik for the *USS Tortuga* to arrive with the MAGTF 2 equipment it needed to move to Hommelvik.

Table 6. Phase III timeline

Event	Time (Zulu)
JHSV departs Rota	0700 13 Feb
JHSV arrives Larvik	2000 16 Feb
JHSV departs Larvik	1700 20 Feb

Observations

- When the M-198's were loaded in Morehead City, North Carolina, the Port Operations Group utilized an MC-4000 to load them with no noted problems. The vessel arranged to have a rented 6000 lbs forklift for the duration of the trip, which should not have presented any problems. When the offload started and an attempt was made to pick up the M-198 with the rented forklift, with the pintle hook adapter attached to one of the forks, it became apparent this would not work. The adapter slid over only one of the forks and when lifted the fork proceeded to bend excessively. This was determined to be a safety hazard, so using the rented forklift was stopped. The howitzers were pulled off the vessel using a Norwegian Ford F-350 tow truck (Figure 1). Figure 2 shows how the M198s were chained to the tow truck.
- Need to ensure offload sites have compatible slings and/or MHE to maneuver M198's.



Figure 1. Tow Truck pulling M198



Figure 2. M198 to Tow Truck lash up

Phase IV: Larvik to Hommelvik Shuttle

The *Joint Venture* made one trip to shuttle MAGTF 2 equipment between Larvik Hommelvik during this phase.

Phase IV load out

Table 7 shows the personnel embarked on *Joint Venture* during this phase of the LOE. The 2nd Marine Regiment personnel included 79 Marines from the 2nd Light Armored Reconnaissance Battalion and 3 Marines from the MAGTF Combat Service Support Detachment.

Table 7. Phase IV embarked personnel

	Number
Crew	31
Tech reps/others	16
Marine Security Company Europe	20
2nd Marine Regiment personnel	82
Total	149

Table 8 describes the equipment transported from Larvik to Hommelvik by the *Joint Venture* during this LOE phase. Originally, the plan was for 36 LAVs to be shuttled from *USS Tortuga* to Hommelvik. During discussions with the 2nd Light Armored Reconnaissance Battalion staff, concerns over weather conditions during the transit led to a decision to only use the vessels "heavier" tie-down points to ensure that the LAV's were safely and securely tied down for sea. This forced a modification of the load to 26 LAVs and six HMMWVs. The weight of the vehicles and passengers moved during this deployment was 818,662 pounds.

Table 8. Equipment shuttled from Larvik to Hommelvik

Equipment	Planned	Actual
LAV	36	26
HMMWV		6
Ship's 6000 lb forklift	1	1
Total items	37	33

Phase IV timeline

Table 9 shows the vessel's port arrival and departure times during this phase of the LOE. Offload of the 32 MAGTF 2 vehicles in Hommelvik took 25 minutes. After the offload, the *Joint Venture* returned to Larvik, Norway where it prepared for Navy experimentation.

Table 9. Phase IV vessel movements

Event	Time (Zulu)
JHSV departs Larvik	1700 20 Feb
JHSV arrives Hommelvik	1800 21 Feb
JHSV departs Hommelvik	0500 22 Feb
JHSV arrives Larvik	1300 23 Feb
JHSV departs Larvik	0700 24 Feb

Observations

- It had been discussed with MAGTF 2 that tray rations would be utilized to feed the MAGTF 2 Marines during the Larvik to Hommelvik transit. When the Marines came aboard, they had MRE's. It was discussed and the Marines would try to bring some for the retrograde movement in order for this vessel to test its ability to feed embarked Marines utilizing tray rations.
- Certain points of the load plan were not correctly depicted. For example, there is insufficient space between the converter vans and the mezzanine deck stanchions for two LAV's positioned abreast of each other. Also the "flex joints" were a factor in where to place the LAV's. The Integrated Computerized Deployment System (ICODES) needs to be updated to include JHSV "flex joints" and tie down points.

Phase V: Tactical Field Training Exercise

The *Joint Venture* returned from Navy experimentation when the vessel put into the port of Orkanger, Norway at 2215 local on 8 March. Table 10 describes how the vessel supported MAGTF 2 during Battle Griffin 02. When not in direct support of the MAGTF, the *Joint Venture* conducted exercises with NATO naval forces.

Table 10. *Joint Venture* use during the FTX

Date	Mission
9 March	Support Distinguished Visitor (DV) demonstration rehearsal
10 March	Support DV demonstration; Embark Kyrksæterøra assault force
11 March	Execute Kyrksæterøra assault; Navy Bilats
12 March	Navy Bilats
13 March	Support King of Norway demonstration
14 March	MAGTF 2 Orkanger to Hommelvik redeployment (20 BV-206s)
15 March	MAGTF 2 Hommelvik to Larvik redeployment (26 LAVs, 6 HMMWVs)

During the 9 March demonstration rehearsal, the *Joint Venture* was able to get its ramp down and ready for vehicle use within 2 ½ minutes after making contact with the pier.

MAGTF 2 Kyrksæterøra assault

Joint Venture's largest contribution to the Battle Griffin 02's tactical play was its use in the MAGTF's assault on the port of Kyrksæterøra, about 75 nm from Hommelvik. Battle Griffin 02 saw NATO's participating forces divided into Blueland and Limeland (the aggressors). *Joint Venture* was placed under Limeland naval control and ordered to support MAGTF 2, who reported to the Norwegian 6th Division (Limeland's land forces commander).

The exercise scenario had Limeland forces invade Blueland, a NATO member nation, to exercise operations under Article V of NATO's charter. This article states an aggression towards a NATO member country is considered an act of aggression towards all member nations. As part of the larger Limeland invasion, a battalion-sized landing at the port of Kyrksæterøra was to neutralize Blueland combat forces, and find gaps in the enemy's front to enable subsequent operations

The assault plan included three phases:

- Phase I: Marine rifle company air assault (via Norwegian UH-1Ns) to secure Kyrksæterøra port facilities for follow-on forces use
- Phase II: Marine company-sized ship-borne landing of task force vehicles and CSSD to reinforce the air assault elements
- Phase III: Consolidate forces and continue advance into Blueland.

A Norwegian LCT joined the *Joint Venture* in phase II. The LCT carried eight BV-206s and five HMMWVs, and the 1st Battalion / 8th Marine Regiment Tactical Command Post. It conducted a beach landing in the vicinity of Kyrksæterøra to isolate the ingress/egress routes to the port.

Mission load out

Table 11 shows the personnel embarked on the JHSV for the Kyrksæterøra assault. It includes five Norwegian Home Guard personnel and their Mercedes light tactical vehicle. They were embarked to augment the vessel's force protection force.

Table 11. Personnel embarked for the Kyrksæterøra assault

	Number
Crew	31
Tech reps/others	16
Marine Security Company Europe	20
2nd Marine Regiment personnel	108
Norwegian Home Guard	5
Total	180

Table 12 shows the number and types of vehicles that were combat loaded for the Kyrksæterøra assault. The MAGTF assault force included 108 Marines and 24 vehicles. The loaded vehicles were not gripped down for this mission. It was decided this was not required because the vessel was to remain in the calm waters of the fjords during this mission.

Table 12. Equipment load for the Kyrksæterøra assault

Equipment	Sub-total	Number
Norwegian Mercedes light tactical vehicle		1
LAVs (4 LAV-25, 1 LAV-L)		5
BV-206 CSS Detachment		4
HMMWVs		15
Heavy Machine Gun hardbacks	5	
81mm mortars highbacks	4	
TOW hardback	2	
Engineer highback	1	
M1097 Avenger (air defense)	2	
Air Defense highback + trailer	1	
Total items		25

Mission timeline

The JHSV embarked its portion of the Kyrksæterøra assault force when it completed its DV demonstration tasking on the afternoon of 10 March at Orkanger. The JHSV's Combat Cargo Officer called ahead and told the Battalion to arrange the 24 vehicles on the pier in the order that they wanted them to be combat loaded. Table 13 shows the timeline for the major events in the loading of the JHSV for the mission. Highlights of the day include:

- Time JHSV pier side ready to load at Orkanger – 9 minutes²
- Time to combat load 25 vehicles and passengers – 59 minutes

After loading, the vessel returned to Hommelvik, which was the Limeland staging area for the “on-call” Kyrksæterøra assault.

² Includes time vessel entered into restricted maneuvering, pivoting 180 degrees in order to position starboard aft quartering ramp on the pier, mooring, lowering ramp, and ready to onload vehicles and personnel.

Table 13. Loading for Kyrksæterøra mission (10 March)

Event	Time (Local)
JHSV pier side at Orkanger	1410
JHSV moored	1413
JHSV ramp down, ready to load	1419
Loading starts	1426
Loading complete	1525
JHSV departs Orkanger	1603
JHSV pier side Hommelvik	1710
JHSV moored	1711
JHSV ramp down	1715

The actual mission was executed on 11 March. Table 14 describes the major events of the mission. Kyrksæterøra was a 60 nm trip from Hommelvik. During the trip, *Joint Venture* averaged 37 knots while underway.

Highlights of the mission include:

- Time pier side ready to offload – 1 minute
- Time to off-load 25 vehicles – 12 minutes
- Time JHSV spent pier side – 22 minutes.

Figure 3 shows one of the assault force LAV-25s rolling off the ship. While the offload went quickly, it could have gone quicker. The offload was delayed twice by traffic stoppages on the pier and peacetime safety requirements for the vessel to be “tied” to the pier with mooring lines prior to cargo offload. It is assumed that vessel station keeping capability and the ramp on the pier would be sufficient to hold the vessel in place for future experimentation or real world operations.

Table 14. Timeline for Kyrksæterøra mission execution (11 March)

Event	Time (Local)
JHSV departs Hommelvik	0526
JHSV diverted to safe haven Alpha	0645
JHSV underway again for Kyrksæterøra	0920
JHSV pier side Kyrksæterøra	1015
JHSV moored / ramp down	1016
Norwegian Mercedes light tactical vehicle off	1017
First assault vehicle off	1018
Last vehicle off	1028
Marines walking off	1033-1035
JHSV ramp up	1036
JHSV underway	1037



Figure 3. LAV-25 offload during Kyrksæterøra assault

Orkanger to Hommelvik redeployment

Joint Venture was tasked with moving 20 BV-206s and 172 MAGTF 2 personnel from Orkanger to Hommelvik at the conclusion of the exercise. The vehicles were driven on and off in a semi-circle (horseshoe) pattern, requiring only ten minutes to both load and offload. This saved having to load BV-206s onto tank transporters for the drive back to Hommelvik.

Hommelvik to Larvik redeployment

The *Joint Venture* returned the 32 vehicles (see table 8) it previously moved from Larvik to Hommelvik back to Larvik for transportation back to the United States on the *USS Tortuga*. Beside the vehicles, 106 passengers were embarked. Tray rations were used to feed breakfast to the embarked MAGTF 2 Marines during the transit.

The vessel started loading the LAVs in the same horseshoe pattern that worked for the BV-206s. Due to their size and number, the LAVs didn't load very well this way in the tight space of the vehicle deck. Loading speed picked up when the LAVs were brought up the ramp, spun around on the stern, where there was plenty of room, and backed into place. The Marines were used to this, having done it in a previous event. This allowed vehicles to be loaded in all three lanes at once, speeding up the process. Loading the vessel took 2 ½ hours. The offload at Larvik took only 22 minutes. This included having to tow one LAV off the vessel.

Observations and Recommendations

In general, this LOE looked at JHSV use in inter- and intra-theater cargo movement, and in direct support of a MAGTF operating in a littoral environment. This LOE included the embarkation of several new vehicle types on the JHSV. These included:

- M1046 (TOW HMMWV)
- M1097 Avenger (air defense HMMWV)
- Norwegian BV-206s.

In this LOE, the JHSV successfully demonstrated its ability to support both MAGTF operational maneuver and the inter- and intra-theater movement of cargo and passengers between ports. The HSV's shallow draft, high-speed, maneuverability, and ability to conduct independent operations in a variety of minor and degraded ports allow the vessel to access offload points not available to other shipping. The HSV is well suited for moving MPF and ARG equipment from in-transit support bases to MAGTF positions in the operating area as part of a multimode transportation system. Further experimentation is required to assess the vessels capability to support ship-to-ship movement of personnel and cargo between sea-based platforms.

Future concept development must bear in mind that the *Joint Venture's* aluminum hull makes it vulnerable to hostile fire. The concept of employment must be limited to permissive and semi-permissive environments. The Kyrksæterøra assault was an ideal demonstration of a HSV employment in a semi-permissive environment. It must be emphasized that these types of vessels provide a unique capability. They are not envisioned as forcible entry platforms or expected to operate in environment where they would take hostile fire. If the desire is for the vessel to support MAGTF operations in hostile environments, stronger hull materials and the installation of self-defense weapons need to be explored and assessed.

The rest of this section consolidates the observations of each of the LOE phases. It is organized by LOE objectives and hypotheses. Observations recorded in past LOE reports are not repeated here. Annex A contains a summary of the questionnaire responses used to develop the quality of life recommendations.

Onboard compatibility of USMC vehicles and bulk cargo

- Morehead City M198 loading evolution was enhanced by high tide conditions at the time of the offload/onload. This created a straight stern quartering ramp, eliminating the joints in the ramp that made loading the Bulk Fuel Company's palletized loads unstable.
- Vessel's crew modified the extensions of the stern quartering ramp, which improved the rolling stocks accessibility to the vehicle deck.
- There were no height clearance issues with loading M198s. Because of the vehicle deck support stanchions, the howitzers must be loaded facing fore or aft.

- M198s were loaded at Morehead City using two methods. First was to use a RT-4000 to pull the gun into the vessel, the other was to push the gun in using a RT-4000. Pushing was more efficient.
- When not married to a prime mover, the M198's towing point requires dunnage to eliminate a steel-on-steel storage situation.
- There was an issue regarding the width of the ramp support cables obstructing the offload of fuel hose boxes.
- Also, the hump/knuckle in the ramp created situations where the top pallet of double-stacked pallets on MHE nearly toppled due to severe motions caused by transiting the ramp knuckles
- Certain points of the load plan were not correctly depicted. For example, there is insufficient space between the converter vans and the mezzanine deck stanchions for two LAV's positioned abreast of each other. Also the "flex joints" were a factor in where to place the LAV's. ICODES needs to be updated to include JHSV "flex joints" and tie down points
- MAGTF assault force loading slowed by inexperienced ground guides.
- Separate access to passenger and vehicle decks would allow concurrent loading and speed the on-/offload process.
- Vessel was modified to mount self-defense machine guns at Little Creek, Virginia prior to the Atlantic crossing.
- Formal computerized loading to establish trim or displacement for the Kyrksæterøra assault was not required. Vessel's Combat Cargo Officer told the Battalion to arrange the vehicles on the pier in the order that they wanted them to come off. Future concern would be vessel's trim/stability if larger/heavier loads were embarked without formal planning.
- Future vessel should have a decontamination station at both the vehicle and passenger entries. Fresh water wash-down facilities will support unit redeployment, agricultural concerns, and nuclear, biological, and chemical (NBC) requirements.

High-speed/high-payload performance

- Ports used in the FTX had adequate fendering and bollards so the vessel never had to use organic fendering. In future experimentation or real world operations, access to minor, degraded, or austere ports may require the JHSV to provide its own fendering.
- *Joint Venture's* high speed allowed for planning to include the vessel executing its own amphibious deception operation. The vessel was to go pass the objective, enter a fjord, then return to the objective area. The deception was not executed.
- A future experiment should include an offload of the vessel without tying up to the pier. It could use its water jets to keep the vessel in place.

Onboard compatibility of USMC rotary-winged

- *Joint Venture* was not certified to support AH-1W or UH-1N operations. These were only aircraft types used in MAGTF 2 operations.

Command and Control

- *Joint Venture* has two HF radios, with one available for MAGTF 2 use. The other was used to communicate with other naval forces in the exercise.
- Due to changes in the execution of the exercise, MAGTF 2 did not require use of the shipboard C4I spaces.
- MAGTF 2 liaison attempted to use the *Joint Venture's* C4I space to communicate with the MAGTF 2 command post. He got through using POTS after trying HF radio, cell phone, and IMMARSAT. The other systems were blocked by the terrain surrounding the fjord.

Bilateral interoperability

- No issues with on-/off-loading the BV-206 from the JHSV.
- Vessel Marine Security Company detachment supplemented by Norwegian Home Guard.

High-speed transit effects on personnel and equipment

Safety, health, and habitability requirements necessary for embarked troops

- Tray rations were used to feed breakfast to the embarked MAGTF 2 Marines during the Hommelvik to Larvik redeployment.

Vessel stowage environment for all operational climates

- Embarked Marine personnel gear storage further taxed by additional cold weather gear requirements.

Effects of high/low speed transit will not degrade the performance capabilities of the embarked personnel and equipment

- Short ranges traveled by the *Joint Venture* (longest with Marines was 60 nm) in fjords which had very calm waters required no gripping of embarked vehicles or treating Marines for sea sickness.

Extreme environment

Vessel's performance and capabilities

- *Joint Venture* produced its own "fog" (water freezing after being kicked up by the water jets), which allows one to track the ship like a jet contrail. It also may effect helicopter operations.
- When turning in areas with shallow depth, the waves created by the vessel may affect small boats operating in the vicinity.
- Large tidal ranges in the fjords led to situations where the vehicle deck was at the same height as the pier. This puts the shipboard section of the stern quartering ramp below the pier, creating obstructions to the RO/RO capabilities of the ramp.

- Vessel was modified for cold weather operations at Little Creek, Virginia prior to the Atlantic crossing. These included:
 - Added heaters for water injectors, voids, and overheads
 - Anti-freeze added for water jet controls
 - Embarked two portable heaters (one used to heat reverse-osmosis unit)
 - Embarked pressure washer to de-ice flight and vehicle decks
 - Embarked sand/salt mix, bats, and extreme weather clothes for the crew.

Embarked personnel performance and capabilities of the embarked personnel and equipment

- Snow blowing into the open vehicle deck led to icing conditions and all the associated problems that come with ice.

Medical

- Casualty care and management should be located in the most stable areas of the vessel (mid-ship or aft in a catamaran).

Quality of Life

- Design the following improvements for embarked troop seats:
 - Increase width of seats to accommodate extra clothing/equipment worn by individuals. Increase spacing between individual seats (i.e. elbow room)
 - Increase amount of legroom or space between seats
 - Increase amount of "adjustable" recline in seats to improve sleeping comfort. Many Marines were stretching out on the deck to sleep vice staying in seats.
 - Install cup or can holders for drinks
 - Install fold-down tables to accommodate snacks, letter writing or paperwork in general.
- Increase ventilation in the troop areas and heads to control odors, smoke, steam, etc. Relates to comfort, morale, rest, and readiness.
- Ensure "safe" troop access to weather decks to enhance mission readiness, comfort, and to ease symptoms of "seasickness". If possible embarked troops should have access at all times, weather permitting.
- Continue and/or increase "snack service capability" aboard ship to enhance troop morale, motivation, comfort, and mission readiness.
- Design and install a "full service" mess deck that can support a fully manned crew and the maximum number of embarked troops.
- In lieu of a "full service" mess deck, recommend the installation (at minimum) of a "tray ration oven" in the mess area to facilitate "hot meals" for embarked troops.

Annex A: Responses to Quality of Life Questionnaire

Table A-1 summarizes the responses to the quality of life questionnaire filled out by two MCWL ship riders and the twenty Marines of 1st Squad, 2nd Platoon, Marine Corps Security Company Europe.

Table A-1. Quality of life questionnaire responses

A	Respondents.	Qty
	1. Gender. a. Male: b. Female:	 22 0
B	Berthing. <i>Note: Berthing for embarked troops was limited to "surge facilities" for 40 PAX. All other PAX remaining overnight slept in their seats or stretched out on the deck. The "surge berthing" consisted of 3-rows (of varying lengths) of <u>canvas</u> racks stacked 3-high. Each person received 1-blanket, 1-pillow, 1-pillow case, and 1-nylon sleeping bag.</i>	
	1. Personnel that were assigned berthing (bed space):	90%
	2. Personnel that were issued bedding items: a. Mattress (sleeping bag): b. Pillow: c. Pillow case: d. Sheet: e. Ticking: f. Blanket: g. Privacy Curtain for individual racks:	 75% 94% 50% 29% 21% 94% 100%

	3. Personnel that were satisfied with bedding items:	
	a. Mattress (or equivalent):	94%
	b. Pillow:	94%
	c. Pillow case:	94%
	d. Sheets:	94%
	e. Ticking:	94%
	f. Blanket:	94%
	g. Privacy Curtains for individual racks:	94%
	4. Personnel satisfied with "privacy" of the berthing area:	82%
C	Toilet Facilities-Male Only. <i>Note: Facility had 2-sections (1) a shower area and (2) a toilet-urinal area. Each section had 2-sinks, 1-mirror, 1-trash can, 1-soap dispenser, 1-paper towel dispenser.</i>	
	1. Personnel satisfied with toilet location (i.e. convenient access from berthing, seating area, messing, etc.):	100%
	2. Personnel satisfied with toilet amenities (quantity, functionality):	
	a. Sinks [2 in shower area, 2 in toilet area]:	95%
	b. Mirrors [1 long mirror over each set of sinks]:	100%
	c. Urinals [a single trough accommodating 4 men abreast]:	95%
	d. Toilets [total of 4]:	90%
	e. Showers [2 shower stalls]:	90%
	f. Paper towel dispenser [1 adjacent to each set of sinks]:	95%
	g. Soap dispenser [1 adjacent to each set of sinks]:	100%
	h. Trash receptacle [1 in shower section and 1 in toilet section]:	100%
	i. Electric hand dryer [1 adjacent to each set of sinks]:	95%

	3. Personnel satisfied with the availability of hot water:	
	a. In sinks:	95%
	b. In showers:	95%
	4. Personnel satisfied with toilet availability (operating & functional):	85%
	5. Personnel satisfied with toilet cleanliness:	90%
	6. Personnel satisfied with toilet ventilation: (control steam, odors)	75%
D	Embarked Troop Seating Area. <i>Note: Seating was designed for short duration, high capacity, civilian ferry customers. Seats were high backed, closely spaced, legroom was confining but minimally sufficient, and seats were adequately reclining. All sufficient for "short duration" civilian transits.</i>	
	1. Personnel satisfied with comfort of the seats:	100%
	2. Personnel recommending seat improvements (for extended trips):	
	a. Increase seat width:	65%
	b. Increase legroom:	80%
	c. Increase amount of seat recline (enhance sleep comfort):	55%
	d. Increase seat cushioning:	30%
	e. Install small table in armrest:	25%
	f. Install cup/can holders:	50%
	g. Install seat back pocket: (for books, mail, notepads, etc)	35%
	3. Personnel <u>dissatisfied</u> with amount of area noise:	63%
	4. Personnel satisfied with temperature control:	85%
	5. Personnel satisfied with ventilation in seating area:	95%
	6. Personnel satisfied with 'table' area: (play cards, write letters, etc)	100%

	7. Personnel satisfied with intercom system (for comprehension):	95%
	8. Personnel satisfied with weather deck access:	95%
	9. Personnel that think weather deck access is	
	a. Absolutely necessary:	50%
	b. Recommended, but not necessary:	40%
	c. Neither recommended nor necessary:	10%
	10. Reasons personnel desire weather deck access:	
	a. Get some fresh air:	80%
	b. Smoke cigarettes:	55%
	c. Eat snacks:	35%
	d. Talk with friends:	55%
	e. Escape seating area's noise and atmosphere:	70%
E	Mission Readiness of Personnel (as relates to ship's at-sea stability).	
	1. Personnel desiring visibility outside ship: (to ease dizzy/nausea)	100%
	2. Personnel desiring weather deck access: (fresh air eases seasick)	80%
	3. Personnel experiencing dizziness:	70%
	4. Personnel experiencing nausea:	65%
	5. Personnel that "got sick" due to dizziness/nausea:	30%
	6. Transit time when personnel became dizzy/nauseous:	
	a. Less than 1-hour:	25%
	b. After 1-hour:	31%
	c. After 2-hours:	25%

	d. After 3-hours:	6%
	e. After 4-hours or more:	13%
	7. Personnel with access to "seasick" medication:	95%
	8. Mission readiness level after 48 hours at-sea:	
	a. 100% mission ready:	32%
	b. 90% mission ready:	47%
	c. 80% mission ready:	5%
	d. 70% mission ready:	5%
	e. 60% mission ready:	5%
	f. 50% (or less) mission ready:	5%
	9. Personnel concurring that "hot meals" enhance readiness:	93%
F	Ship Support. <i>Note: There was no storage area for large personal baggage. Seabags and ALICE Packs were piled on pallets in the vehicle deck and covered with a tarp to minimize exposure to rain and weather. In the embarked troop Seating Area there was no storage for small "carry-on" items (gym bags, clothing and equipment that troops removed for comfort reasons during the transit). Personnel were forced to stack items in any available space in the seating area, which created trip hazards and/or obstacles to movement.</i>	
	1. Personnel <u>dissatisfied</u> with large bag storage: (seabag, ALICE Pk)	70%
	2. Personnel <u>dissatisfied</u> with storage for small bags: (carry-on)	35%
	3. Personnel opinions regarding snack bar services:	
	a. Increases level of comfort during transit:	75%
	b. Decreases dizziness and nausea:	30%
	c. Increases dizziness and nausea:	15%
	d. Keeps motivation and energy level high:	70%

	e. Helps pass the time when bored:	75%
G	Respondents Comments.	
	<p>1. Recommendations for QOL improvements:</p> <p>a. Install more sinks, toilets, showers to support max occupancy</p> <p>b. Increase sewage containment (CHT) to support maximum occupancy while moored adjacent to austere piers (no port sewage support)</p> <p>c. Provide sea bag stowage area(s) that are not exposed to the weather</p> <p>d. Provide storage in vicinity of seating area for small carry-on items</p> <p>e. Install an armory facility to secure crew-serve & personal weapons</p> <p>f. If an armory is not available, install rifle racks in vicinity of troop area for security and ease of movement on the vessel while at-sea</p> <p>g. Provide berthing for at least "half" of the embarked troop occupancy rate. Port-Starboard or "hot-racking" could then be an option.</p> <p>h. Install sufficient weapons mounts around vessel for ship self-defense</p>	

Experimental Embarkation Summary Statistics

This annex provides summary statistical information from JHSV experimentation during the October 2001 to March 2002 time frame. For more details, see the annex containing the LOE quicklook report for each event.

Table X-1 shows all the vehicles and towed items that participated in JHSV experimentation. Only the IFAV and HMMWV were tested on the vessel's internal ramps and mezzanine level. Because of minimal overhead clearance in these areas, it was decided not to use these the internal ramps or mezzanine level during at-sea periods. Any vertical movement would cause damaged to stored IFAVs or HMMWVs.

Table X-1. Vehicle JHSV compatibility/maneuverability problems

Vehicle	Starboard Aft Quartering Ramp	Main Vehicle Deck
IFAV	None	None
BV-206 (Norwegian tracked vehicle)	None	None
M998 (HMMWV)	None	None
M998 with M116 trailer	None	None
M1046 (TOW HMMWV)	None	None
M1097 Avenger (Air Defense HMMWV)	None	None
M923 (5-ton truck)	None	None
M923 + welding trailer	None	None
M927 (5-ton long-bed) + trailer	None	Turning radius restricted movement
M817 (Dump truck) + M353 trailer	None	None
M915 (Tractor) + M872 (flatbed trailer)	Bottom-out (unleveled ramp)	Not tested
Mk48 + Mk16 + Mk870 (LVS power unit + fifth wheel + low-bed trailer)	Load weight all on one axle on non-level ramp	Limited stowage locations
M198 (155mm Howitzer)	None	None
AAV	None	Damaged pad-eyes
LAV-25	None	None
EBFL	None	None
TRAM	None	None
RT-4000 Forklift	None	None

Table X-2 shows the ramp deployment and recovery times that were recorded during JHSV experimentation. Ramp deployment time is defined, as the time the vessel is pierside to when it is ready to load or unload cargo using the stern aft quartering ramp. Ramp recovery time is the time from when the vessel starts lifting the ramp to when it is locked into its storage configuration or the vessel is underway. Ramp deployment and recovery times decreased over time for a number of reasons:

- Experience gained from working with the vessel
- Starting ramp deployment while vessel still coming alongside the pier. Early events had the vessel tying up to the pier before starting to deploy the ramp.
- Vessel getting underway while recovering the ramp.

Table X-2. Ramp deployment/recover times

Date	Event	Time
18 Oct 01	Deployment	29 minutes 15 seconds
18 Oct 01	Deployment	12 minutes 37 seconds
18 Oct 01	Recovery	11 minutes 15 seconds
9 Mar 02	Deployment	2 minutes 30 seconds
10 Mar 02	Deployment	3 minutes
10 Mar 02	Deployment	4 minutes
11 Mar 02	Deployment	1 minute
11 Mar 02	Recovery	1 minute

Ramp deployment consists of three steps. First, the two-section ramp is mechanically lowered into place. If the pier has a curb, wood braces are placed under the ramp section to keep it off the pier curb. Then wooden inserts are placed between the vessel and the first ramp section. These were designed and included after the first LOE to minimize the angle between the vessel and ramp at any pier height. Next, aluminum wedges are placed between the two ramp sections walls. These eliminate flexing of the two ramp sections while vehicles drive up the ramp. Finally, two ramp extensions are placed on the pier end of the ramp to allow smooth access to the ramp.

Table X-3 summarizes JHSV experimental loads and load times when known. Except for the 10 March event, all of the events were considered administrative load outs, so minimizing time the loading time was not a major consideration. Times for two experimental loads were not recorded. For the 10 January event, three TRAMs and a RT-4000 forklift were used to load the breakbulk cargo.

Table X-3. Load times

Date	Equipment loaded	Time
28 Nov 01	8 x AAV	27 minutes 13 seconds
10 Jan 02	96 breakbulk items/9 vehicles, 159 pax	4 hours 14 minutes
5 Feb 02	96 breakbulk items/9 vehicles, 159 pax	Unknown
6 Feb 02	11 x M198	2 hours 15 minutes
20 Feb 02	26 x LAV, 6 x HMMWV	Unknown
10 Mar 02	5 x LAV, 4 x BV-206, 15 x HMMWV, 1 x IFMV, 113 pax	59 minutes
14 Mar 02	20 x BV-206, 172 pax	10 minutes
15 Mar 02	26 x LAV, 6 x HMMWV, 106 pax	2 hours 30 minutes

Table X-4 summarizes JHSV experimental offload times. Except for the 11 March event, all of the offloads were conducted administratively. For the 11 January event, two TRAMs were used to offload the breakbulk cargo. One TRAM, two RT-400 forklifts, and the ship's organic 6000 lb forklift were used in the 6 February breakbulk cargo offload.

Table X-4. Offload times

Date	Equipment offloaded	Time
29 Nov 01	8 x AAV	16 minutes 14 seconds
11 Jan 02	96 breakbulk items/9 vehicles, 159 pax	7 hours 20 minutes
6 Feb 02	96 breakbulk items/9 vehicles, 159 pax	2 hours 37 minutes
17 Feb 02	11 x M198	1 hour 40 minutes
21 Feb 02	26 x LAV, 6 x HMMWV	25 minutes
11 Mar 02	5 x LAV, 4 x BV-206, 15 x HMMWV, 1 x IFAV, 113 pax	12 minutes (veh only) 19 minutes (veh+pax)
14 Mar 02	20 x BV-206, 172 pax	10 minutes
16 Mar 02	26 x LAV, 6 x HMMWV, 106 pax	22 minutes

Table X-5 describes the payload weights embarked aboard the *Joint Venture* during experimental transits. Items used to calculate the payload for each of these voyages include:

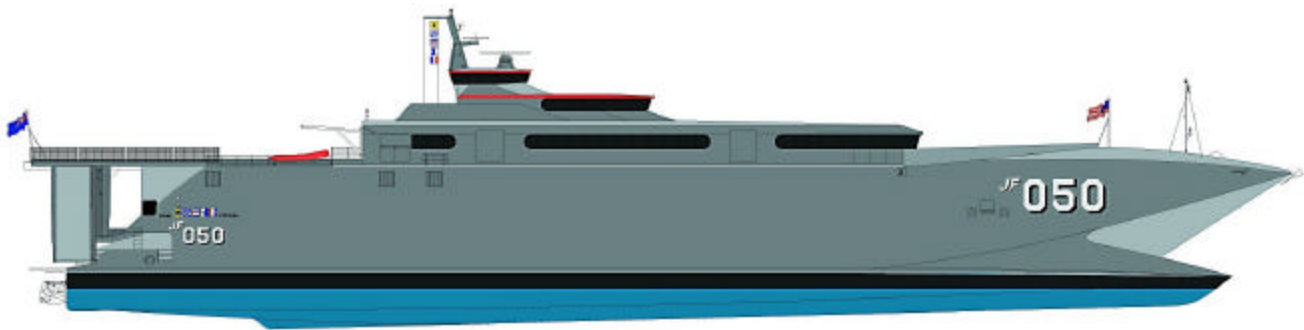
- Embarked Marine vehicles and cargo
- Embarked Marine personnel
- Ship riders in excess of those personnel required to operate the vessel.

All loads after 10-11 January include a 6000 lb forklift the ship rented for use doing Battle Griffin 02. The *Joint Venture's* maximum payload is 1.09 million pounds or 545 short tons.

Table X-5. Payloads embarked aboard JHSV

Date	Equipment onboard	Weight (lbs)	Weight (MTons)
28-29 Nov 01	8 x AAV	422,160	
10-11 Jan 02	96 breakbulk items/9 vehicles, 195 pax	479,602	
5 Feb 02	96 breakbulk items/9 vehicles, 175 pax	487,682	
6-16 Feb 02	11 x M198, 16 pax	192,218	
20-21 Feb 02	26 x LAV, 6 x HMMWV, 118 pax	818,662	
11 Mar 02	5 x LAV, 4 x BV-206, 15 x HMMWV, 1 x IFAV, 149 pax	343,089	
14 Mar 02	20 x BV-206, 208 pax	276,480	
15-16 Mar 02	26 x LAV, 6 x HMMWV, 142 pax	825,862	

Millennium Challenge 02 Limited Objective Experiment



Joint High Speed Vessel Analysis Report

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August 2002

Distribution authorized to the Department of Defense and U.S. DoD contractors only,
administrative or operational use, August 2002. Other requests shall be referred to
CG MCWL, 3255 Meyers Ave, Quantico, VA 22134.

Enclosure (7)

Introduction

Joint Venture (HSV-X1) took part in Joint Forces Command (JFCOM) Joint Experiment Millennium Challenge 02 (MC 02). Marine Corps experimentation with the vessel was conducted during the STOM phase of MC-02 and was coordinated with NWDC's employment of *Joint Venture* in support of Fleet Battle Experiment-Juliet (FBE-J). It was determined that this venue provided an excellent opportunity to explore the operational and tactical employment of a high-speed vessel (HSV) in direct support of a Marine Air-Ground Task Force (MAGTF) operating in a littoral environment.

Joint Venture is a 96-meter (313 foot) commercial catamaran car ferry chartered from Bollinger/Incat USA capable of sustained speeds in excess of 40 knots. The Army, Navy, Marine Corps, Special Operations Command, and Coast Guard have chartered this experimental Joint High Speed Vessel (JHSV) for a 12-month project to assess the vessel's capabilities and limitations to determine its "general" military utility for potential operational and tactical employment.

Joint Venture has undergone modifications to enhance its military utility. These include:

- Ability to launch/recover small boats
- A stern quartering ramp was added for independent vehicle offload
- A flight deck was added to allow day/VFR flight operations with CH-46 and SH-60 aircraft
- A limited command, control, communications, computers, and intelligence (C4I) capability was added.

Marine Corps experimentation with the JHSV centers on its capabilities within the context of Expeditionary Maneuver Warfare (EMW). Efforts are focused to determine what impacts the JHSV has on future operational concepts throughout the deployment, employment, sustainment and redeployment cycle. Additionally, exploration into future JHSV tactics, techniques, procedures, and technologies (TTPT) and the complementary nature of the vessel with amphibious and maritime prepositioning ships will be conducted.

This report only addresses the JHSV operations that supported live Marine Corps operations during MC 02. High Speed Vessels were used to support the Experimental Marine Expeditionary Brigade in the simulated portion of MC 02. Documentation of the missions performed by the simulated vessels will be provided in the MARFORLANT MC 02 Assessment Team' report.

Objectives

JHSV was employed in Millennium Challenge 02 to assess the role of high-speed vessels in STOM and during MAGTF operations in a littoral environment to include the following missions:

- Insert/Extract Reconnaissance, Surveillance, Target Acquisition (RSTA) elements

- Reinforcement of MAGTF forces ashore in order to sustain operational momentum
- Humanitarian / medical evacuation of personnel (non-combatants)
- Command and Control of landward and seaward forces
- Intra-theater lift of cargo and personnel (operational).

The Limited Objective Experiment (LOE) was planned with two major objectives and their associated hypotheses.

- HSV role in operational maneuver during MAGTF operations in a littoral environment
 - Onboard compatibility and interoperability of USMC ground vehicles, small boats, rotary aircraft and cargo. If the vessel has a vehicle ramp, an overhanging crane system and main deck, then RO/RO, LO/LO and stowage systems will be interoperable with USMC ground vehicles, small boats, rotary aircraft and cargo.
 - HSV Operational Performance. If the vessel is provided with advanced hull and propulsion technology, then it will have the mobility, operational reach, and tactical flexibility required to support sea-borne operations within the context of Expeditionary Maneuver Warfare (EMW).
 - Operational Mission Support. If the JHSV conducts operations in support of a MAGTF operations, then the vessel will be able to support to all mission scenarios in STOM environment to include deploying, employing, sustaining, and redeploying the force.
 - Command and Control (C2). If the vessel is provided with a modular command, control, communications, computers, and intelligence (C4I) infrastructure, then it will provide appropriate C2 in support of MAGTF operations.
 - Joint Force Interoperability. If the HSV conducts evolutions in conjunction with joint forces, then such combined evolutions will not have a degrading effect on the vessel's performance and / or capabilities.
- Ascertain HSV supportability during MAGTF operations in littoral environments.
 - Human Factors & Safety. If the vessel is capable of embarking military personnel then it will provide all safety, health, and habitability requirements.
 - HSV supportability in extreme environments. If the HSV, with advanced hull and propulsion technology, conducts operations in extreme environments, to include adverse weather, sea-state, etc., then the mission effectiveness of embarked vehicles and cargo will not be degraded.
 - HSV survivability in extreme environments. If the HSV, with advanced hull and propulsion technology, conducts operations in extreme environments, to include adverse weather, sea-state, etc., then the vessel's performance and capabilities (mission effectiveness) will not be degraded.

Experiment organization

The experiment plan consisted of three phases:

- *Phase I: Pre-exercise workups* (21 – 27 July 02): This phase began with pierside training on 21 July 02 with the *Joint Venture*. This training included:
 - Combat Rigid Raider Craft (CRRC) launch and recovery while pierside (21 July) and underway (22 July).
 - Flight Deck Landing Qualifications (DLQs) for USMC CH-46Es while *Joint Venture* was underway on 27 July.
- *Phase II: Advance Force Operations* (28 July 02): This phase began with the pierside embarkation of MCWL personnel (26 July 02) aboard the *Joint Venture* for the assessment of Naval Special Warfare advance force operations in support of the STOM phase of MC'02. On 28 July, a detachment of USMC reconnaissance embarked for the conduct of advance force operations in the vicinity of the CPCA Del Mar Boat Basin. The phase concluded with the vessel's return to San Diego following the successful insertion of USMC recon assets.
- *Phase III: STOM support and Non-combatant Emergency Evacuation* (29-30 July 02): This phase began with the onload of I MEF personnel and equipment (29 July 02) aboard the *Joint Venture* in San Diego to conduct a combat reinforcement in the Del Mar Boat Basin and subsequent NEO exercise with follow-on high-speed transport of evacuees on 30 July. This phase concluded with the *Joint Venture's* return to San Diego.

Phase I: Pre-exercise workups

Workups for Millennium Challenge 02 included conducting CRRC launch and recovery training and DLQs using Marine CH-46Es.

Combat Rigid Raider Craft operations

CRRC workups were divided into two phases. The first consisted of a pierside familiarization and SOP development stage, and an underway-training stage.

Pierside training

CRRC operations started on 21 July with two CRRCs conducting pierside familiarization training with the *Joint Venture*. Each boat carried nine Marines, two boat coxswains (from Headquarters Company, 1st Marine Division) and seven Reconnaissance Marines (from the 1st Division Reconnaissance Company, 1st Marine Division).

During this training, four launch and recovery cycles were performed. The fourth launch/recovery cycle was executed with just the boat coxswains and no passengers. Table 1 shows the times for the third CRRC launch during this training. It took a little over two minutes to launch the CRRC and 24 seconds to load the seven passengers.

Table 1. CRRC training launches (21 July)

Event	Launch 3
CRRC lifted off deck	00:00
CRRC over water ready to drop	00:36
CRRC in water	01:32
Sling detached from CRRC	01:57
CRRC underway	02:05
CRRC moored on JHSV port quarter	02:41
First passenger loaded	02:46
Last passenger loaded	03:03
CRRC underway	03:05

Table 2 shows the times for the third and fourth CRRC recoveries during the pierside training period. Again, the fourth iteration did not include passengers. Offloading the

seven passengers took 39 seconds during the third iteration, and recovering the CRRC onboard *Joint Venture* took 1 minute 53 seconds and 2 minutes 40 seconds.

Table 2. CRRC training recoveries (21 July)

Event	Recovery 3	Recovery 4
CRRC moored on JHSV port quarter	00:00	N/A
Passenger off loading started	00:04	N/A
Passenger off loading finished	00:29	N/A
CRRC underway	00:39	N/A
CRRC in position under the crane	00:00	00:00
CRRC sling attached to crane hook	00:22	01:10
CRRC lifted out of the water	00:41	01:24
Engine raised and shut off	00:46	01:41
CRRC level with deck over the water	01:11	02:11
CRRC over the deck	01:45	02:32
CRRC on deck	01:53	02:40

CRRC launching procedures

During this pierside training period, the boat coxswains and Reconnaissance Marines developed procedures to launch CRRCs from the *Joint Venture*. These were:

- Marines position the CRRC, with all Reconnaissance Marine equipment on board, into position on the deck below the ship's crane
- Lower the CRRC into water with two coxswains and all Recon Marine equipment on board
- Once the CRRC is in the water, coxswains put the engine in the water and start
- Detach the CRRC from the crane's hook, and castoff the safety lines
- Once all the CRRCs are underway, the first CRRC moves to *Joint Venture's* port quarter to load the passengers
- When the last CRRC has loaded its passengers, it joins the other CRRCs to proceed on the mission.

Underway training

Underway training occurred on 22 July. It consisted of the single launch and recovery of four CRRCs in sea state 1. Each CRRC had two coxswains. Three CRRCs had four passengers and the fourth CRRC had three passengers. During this period, CRRC engines were deployed and started prior to the CRRC entering the water.

Table 3 provides the timelines for each of the underway training launches. Each of the launches was performed with the *Joint Venture* moving at 2.5 knots. They took between one minute 18 seconds and one minute and 58 seconds to actually launch the CRRCs, and between 20 to 36 seconds to load the Reconnaissance Marines.

Table 3. CRRC at sea launches

Event	Launch 1	Launch 2	Launch 3	Launch 4
JHSV speed at launch	2.5 knots	2.5 knots	2.5 knots	2.5 knots
CRRC lifted off deck	00:00	00:00	00:00	00:00
CRRC over water ready to drop	01:03	00:28	00:42	00:27
CRRC engine deployed and started	01:36	00:57	01:05	01:15
CRRC in water	01:53	01:09	01:17	01:24
Sling detached from CRRC	01:57	01:15	01:29	01:38
CRRC underway	01:58	01:18	01:35	01:47
CRRC moored on JHSV port quarter	00:00	00:00	00:00	00:00
Passengers loaded	3	4	4	4
First passenger loaded	00:05	00:13	00:15	00:08
Last passenger loaded	00:18	00:25	00:30	00:25
CRRC underway	00:20	00:32	00:36	00:29

Table 4 provides the timelines for each of the underway training recoveries. The recoveries were performed with the *Joint Venture* moving between 2.5 to 5 knots. They took between 22 and 40 seconds to offload the Reconnaissance Marines, and one minute 30 seconds and five minutes and 21 seconds to recover the CRRCs.

Table 4. CRRC At-sea recoveries

Event	# 1	# 2	# 3	# 4
JHSV speed at recovery	5 knots	5 knots	4 knots	2.5 knots
Passengers off-loaded	4	4	4	3
CRRC moored on JHSV port quarter	00:00	00:00	00:00	00:00
First passenger off loaded	00:05	00:04	00:06	00:04
Last passenger off loaded	00:36	00:18	00:21	00:15
CRRC underway	00:40	00:22	00:26	00:24
CRRC in position under the crane	00:00	00:00	00:00	00:00
CRRC sling attached to crane hook	00:47	00:26	02:27	00:31
CRRC lifted out of the water	01:05	00:41	02:44	00:52
Engine raised and shut off	01:08	00:35	02:40	00:50
CRRC level with deck over the water	01:37	01:06	03:10	01:22
CRRC over the deck	01:53	01:22	05:10	01:38
CRRC on deck	02:03	01:30	05:21	01:46

Observations

Observations for this phase's CRRC operations include:

- SEALs and Marine Reconnaissance use different SOPs to launch and recover CRRCs.
- CRRCs aft nylon lift handles stressed when lifting boat in/out of water with gear and coxswains on board.
- JHSV's crane block is not conducive to quickly attaching boat straps in CRRC recovery. Leads to a safety issue in at-sea boat recovery
- Crane engine adds to already very noisy vehicle deck, limiting verbal communications.
- Comments from the Headquarters Company Detachment OIC included:
 - MOGAS supply and storage is sufficient only for short duration missions.
 - Crane is an inefficient method to launch/recover multiple boats. A ramp or stern gate is a preferred method.

- Launching CRRCs with this crane was dangerous for personnel. A cradle or harness would improve safety and reduce damage to the CRRCs.

CH-46E Deck Landing Qualifications

CH-46E Deck Landing Qualifications were performed between 1630 and 1745 on 27 July. Table 5 describes the 15 landings and launches completed during the evolution.

Table 5. DLQ event summary (27 July)

Event	Approach	Wind across deck	Retire (side/degrees)	Comments
1	Starboard to port	19 knots	Port/315	Went around radar to avoid
2	Starboard to port	19 knots	Port/315	Went over radar to avoid
3	Starboard to port	19 knots	Port/315	
4	Starboard to port	19 knots	Port/315	Chocked and chained to load 3 passengers
5	Straight on	21 knots	Port/315	
6	Straight on	18 knots	Starboard/90	Hovered and turned to retire
7	Straight on	19 knots	Port/270	Hovered and turned to retire
8	Straight on	18 knots	Port/270	Hovered and turned to retire
9	Straight on	19 knots	Port/270	Hovered and turned to retire
10	Starboard to port	19 knots	Port/315	
11	Starboard to port	22 knots	Port/315	
12	Straight on	21 knots	Starboard/90	Hovered and turned to retire
13	Straight on	21 knots	Starboard/90	Hovered and back off to retire
14	Straight on	20 knots	Port/270	Hovered and turned to retire
15	Straight on	22 knots	Port/270	Chocked and chained to off-load 3 passengers

The approach column describes the flight path taken by the CH-46E, relative to the vessel, to land. The retire column describes the direction and angle from the vessel's course the CH-46E used to take-off.

The *Joint Venture* was on a steady course of 240 degrees from Camp Pendleton's Red Beach at a speed of 9.5 knots for the whole evolution. This left the vessel 19 miles from Red Beach at the end of the DLQ period.

Observations

Observations for this phase's helicopter operations include:

- First time any Marine Corps aircraft have landed on *Joint Venture*.
- Using oblique landings were the only observed way cargo could be loaded/off-loaded on CH-46E. Need to determine if this can be done in straight-on landings.
- For most of the evolution, the Landing Signal Officer (LSO) could be observed from the bridge. When direct observation was limited, deck cameras allowed the bridge to see the LSO.
- Comments from the pilots who flew the DLQs included:
 - While the flight deck was small, it was manageable.
 - The vessel's speed was good. Any slower would have made the landings bumpy. A little more speed would not have created a problem.
 - Deck markings were adequate.
 - The aircraft had good communications with the vessel at all times.
 - Night air operations seemed feasible. The vessel only requires the addition of blue deck lights.

Phase II: Advance Force Operations

The *Joint Venture* embarked Marines and SEALs on 28 July to perform advanced force operations in support of the Ship-to-Objective Maneuver portion of MC 02.

Phase II load out

Table 6 describes the personnel embarked on the *Joint Venture* for this phase. SEALs embarked to perform SEAL Delivery Vehicle (SDV) operations. The Reconnaissance Company Marines performed reconnaissance of Del Mar Boat Basin for the landing. The Headquarters Company Marines provided the CRRCs for the reconnaissance insertion.

Table 6. Phase II embarked personnel

	Number
Crew	27
Tech representatives/others	21
SEALs	12
Headquarters Company, 1st Marine Division	10
1st Division Reconnaissance Company	12
Total	82

Table 7 describes the equipment loaded unto the *Joint Venture* for the phase. The Marine CRRCs were launched from the vessel, but were not recovered.

Table 7. Phase II embarked equipment

Equipment	Number
Ship forklifts	2
Ship CRRC trailer	1
SEAL vehicle	1
SEAL SDV trailer	1
Marine Corps CRRC	4
Total items	9

Phase II timeline

Table 8 provides a timeline for the events that took place during this phase. The SEALs conducted SDV operations sandwich around the Marine Reconnaissance insertion into Camp Pendleton's Del Mar Boat Basin. The plan was to launch the Marine CRRCs at 331233N 1174200W, or 14.8 miles from Del Mar Boat Basin. The actual insertion point was 331268N 1174184W.

Table 8. Phase II timeline (28-29 July)

Event	Time (local)
JHSV underway from San Diego	1645 28 July
JHSV off Coronado	1756 28 July
SDV operations	1814-1900 28 July
JHSV underway to Camp Pendleton	1908 28 July
JHSV reduces speed off Camp Pendleton	2023 28 July
First CRRC positioned under hoist	2036 28 July
First CRRC lifted off JHSV	2039 28 July
Last CRRC lifted off JHSV	2045 28 July
First CRRC passengers loaded	2049 28 July
Last CRRC passengers loaded	2054 28 July
JHSV underway for Coronado	2211 28 July
JHSV off Coronado	2326 28 July
SDV operations	2341 28 July - 0010 29 July
JHSV underway for San Diego	0018 29 July
JHSV moored San Diego	0134 29 July

The CRRCs were launched in sea state 2, with 8 knots of wind from astern of the vessel. The JHSV was moving at 0.4 knots when launching the CRRCs and 2 knots when loading the Reconnaissance Marines. Minimal lighting was used in the aft portion of the vehicle deck during the operation. The four CRRCs were put in the water in six minutes. Loading passengers in the four boats took five minutes. Overall, the entire evolution (from launching the first CRRC to the last having its passengers loaded) took 15 minutes.

Table 9 summarizes the times it took to launch each CRRC and load their associated passengers.

Table 9. CRRC launches for Reconnaissance Marine insertion

Event	Launch 1	Launch 2	Launch 3	Launch 4
CRRC lifted off deck	00:00	00:00	00:00	00:00
CRRC over water ready to drop	00:11	00:19	00:21	00:23
CRRC engine deployed and started	00:32	00:41	00:43	00:47
CRRC in water	00:54	00:50	00:53	00:54
Sling detached from CRRC	01:03	01:01	01:02	01:22
CRRC underway	01:07	01:06	01:32	01:24
Passengers to load	2	4	4	4
CRRC moored on JHSV port quarter	00:00	00:00	00:00	00:00
First passenger loaded	00:06	00:40	00:30	00:14
Last passenger loaded	00:08	01:42	01:06	00:42
CRRC underway	00:08	01:42	01:06	00:42

Observations

Observations for the phase's operations include:

- Chemlites were installed on the crane's block and hook and the end of all tether lines. Look into installing a lighting system of some sort.
- Additional comments from the Headquarters Company Detachment OIC included:
 - The vessel seemed too small to embark a boat raid company for an extended period of time (6 month deployment). For short periods (few weeks), the JHSV seemed ideal for a mission-tailored.
 - Need access to freshwater to wash CRRCs with after missions.
 - Offloading tired or injured Marines from CRRCs to *Joint Venture's* port quarter may generate a dangerous situation.

Phase III: STOM support and Non-combatant Emergency Evacuation

Joint Venture departed San Diego on 29 July to load vehicles at the floating pier constructed of causeway sections at Del Mar Boat Basin for the next day's landing. Appendix A describes Del Mar Boat Basin and the pier constructed there for this experiment. Because of a casualty to the vessel's starboard outer engine, the vessel had to return to port to repair the engine prior to loading the Marine equipment. Table 10 describes the day's events. The plan was adjusted to have the Marine vehicles driven down to Naval Station San Diego to embark the JHSV.

Table 10. Timeline for 29 July

Event	Time (local)
JHSV underway from San Diego	0833
JHSV experiences starboard outer engine casualty	0945
JHSV moored San Diego	1119
Four LAVs arrive at the pier for loading	1420
Four FSSG vehicles arrive at pier for loading	2128
Final FSSG vehicle arrives at pier for loading	2340

Table 11 describes the planned and actual equipment loaded onto the *Joint Venture* for this phase of the LOE. Originally, ten vehicles were to be loaded: four LAVs, three MTVR (7-ton truck), and three LVS's. Because they are just being fielded to the Marine Corps, the MTVR were not licensed to operate off Camp Pendleton. Two 5-ton trucks were driven to the Naval Station to replace the three MTVRs in the load plan.

The five logistic vehicles transported by the *Joint Venture* for the mission were mobile-loaded as follows:

- One LVS with a standard 20-foot ISO container
- One LVS with three PALCONs
- One LVS with three QUADCONs
- One 5-ton with two PALCONs
- One 5-ton with two QUADCONs.

Table 11. Phase III embarked equipment

Equipment	Planned	Actual
LAV-AT	2	2
LAV-L	2	2
5-ton	0	2
MTVR	1	0
MTVR with M353 trailer	1	0
MTVR long-bed	1	0
MK48/14	3	3
Total items	10	9

Table 12 describes the 48 mission essential personnel embarked for this phase. An unknown number of media and observers were also embarked on the vessel for the trip from San Diego to Del Mar Boat Basin. The four LAVs were crewed by the eleven personnel from the 1st Light Armored Reconnaissance Battalion, and the 1st Transportation Support Battalion, 1st Force Service Support Group provided the drivers for the five support vehicles.

Table 12. Phase III embarked personnel

	Number
Crew	27
Tech reps/others	Unknown
1st Light Armored Reconnaissance Battalion	11
1st Transportation Support Battalion	10
Total personnel	48+

Table 13 provides the timeline for the major events that took place on 30 July. Parts for the engine repair arrived at 0300 that morning and repairs were completed before the scheduled departure time. The LVS carrying the ISO container was the first vehicle loaded on the JHSV. Because of an error in the vehicle deck height diagrams, this vehicle could not drive around the forward portion of the mezzanine deck supports in the vehicle deck. Repositioning this vehicle delayed the overall vehicle loading.

Table 13. Timeline for 30 July

Event	Time (local)
Parts for the engine repair arrive	0300
Three LVS's drive on <i>Joint Venture</i>	0628 - 0647
Two 5-tons back on to <i>Joint Venture</i>	0654 - 7002
Four LAVs drive on <i>Joint Venture</i>	0707 - 0715
JHSV underway from San Diego	0748
JHSV stops off Del Mar to launch small boat	1033
JHSV starts backing into Del Mar	1049
JHSV passes basin breakers	1052
JHSV starts docking maneuver	1112
JHSV pierside	1122
Ramp down	1128
Four LAVs drive off	1129 - 1130
Three LVS drive off	1130 - 1131
2 5-tons drive off	1132
NEO come aboard	1136 - 1139
Ramp up	1139
JHSV clear of pier	1142
JHSV starts out of Del Mar	1146
JHSV passes basin breakers	1157
JHSV stops off Del Mar to recover small boat	1205
JHSV moored San Diego	1540

Joint Venture got underway for Del Mar at 0748. While transiting to Del Mar, the vessel sustained a starboard outer engine casualty again. This time, it continued on the mission. Prior to entering the channel to Del Mar Boat Basin, the vessel stopped to launch a small boat, to mark the 15-meter curve in the channel. Because it has better visibility aft, the vessel transited the channel backwards. While transiting the channel, wind speed was about ten knots from a heading of 240 degrees.

The *Joint Venture* started its docking maneuver at 1112. The first vehicle rolled off the vessel 17 minutes later (one minute after the ramp was deployed). The last vehicle followed three minutes after the first. Figure 1 shows the *Joint Venture* maneuvering to come along side the pier. Figure 2 is a picture of one of the LAV-Ls rolling off the vessel.



Figure 1. *Joint Venture* pierside Del Mar Boat Basin

After the vehicles were offloaded, non-combatant evacuees, processed by the MEU Service Support Group-15's Evacuation Control Center were embarked. At 1142, the vessel was clear of the pier and preparing to again back out of the channel (Figure 3). Total time moored to the pier was 20 minutes. It cleared the harbor breakers at 1157. Total time within the restricted waters of the harbor's breakers was 65 minutes. The vessel conducted communications experiments during the transit back to San Diego. It moored at Naval Station San Diego at 1540.



Figure 2. LAV-L debarking the JHSV.



Figure 3. *Joint Venture* leaving Del Mar Boat Basin.

Observations and Recommendations

In general, this LOE looked at JHSV use in intra-theater cargo movement and direct support of a MAGTF operating in a littoral environment. This LOE included several firsts for the JHSV. These included:

- Operating with LAV-AT and Logistic Vehicle System (LVS)
- Successfully launched Marine Corps CRRCs at night
- CH-46E launch and landings
- Moored to a floating causeway section pier in Camp Pendleton's Del Mar Boat Basin.

In this LOE, the JHSV successfully demonstrated its ability to support both MAGTF operational maneuver and the intra-theater movement of cargo and passengers between ports. The JHSV's shallow draft, high-speed, maneuverability, and ability to conduct independent operations in austere ports, like the one created in Del Mar Boat Basin, allow the vessel to access offload points not available to other shipping. Further experimentation is required to assess the vessels capability to support movement of personnel, vehicles, and cargo between sea-based platforms (both amphibious and MPF ships) and the shore.

Future concept development should bear in mind that the *Joint Venture's* aluminum hull makes it vulnerable to hostile fire. The concept of employment must be limited to permissive and semi-permissive environments. This type of craft are not envisioned as forcible entry platforms or expected to operate in environment where they might take sustained hostile fire. If the desire is for the vessel to support MAGTF operations in hostile environments, stronger hull materials and the installation of self-defense weapons need to be explored and assessed.

The rest of this section consolidates the observations of each of the LOE phases. It is organized by LOE objectives and hypotheses. Observations recorded in past LOE reports are not repeated here.

Onboard compatibility and interoperability of USMC ground vehicles, small boats, rotary aircraft and cargo

- Chemlites were installed on the crane's block and hook and the end of all tether lines. Look into installing a lighting system of some sort.
- Recommend a 68-foot wide minimum useable vehicle deck to allow the LVS to make a horseshoe turn without having to do a three-point turn.
- CRRCs aft nylon lift handles stressed when lifting boat in/out of water with gear and coxswains on board.
- JHSV's crane block is not conducive to quickly attaching boat straps in CRRC recovery. Leads to a safety issue in at-sea boat recovery.
- Crane engine adds to already very noisy vehicle deck, limiting verbal communications.

- Comments from the Headquarters Company Detachment OIC on CRRC operations included:
 - MOGAS supply and storage is sufficient only for short duration missions.
 - Crane is an inefficient method to launch/recover multiple boats. A ramp or stern gate is a preferred method.
 - Launching CRRCs with this crane was dangerous for personnel. A cradle or harness would improve safety.
- Need to add an oblique line to the flight deck to give helicopters a reference point during landings.
- Using oblique landings were the only observed way cargo could be loaded/off-loaded on CH-46E. Need to determine if this can be done in straight-on landings.
- For most of the evolution, the Landing Signal Officer (LSO) could be observed from the bridge. When direct observation was limited, deck cameras allowed the bridge to see the LSO.
- Comments from the pilots who flew the DLQs included:
 - While the flight deck was small, it was manageable.
 - The vessel's speed was good. Any slower would have made the landings bumpy. A little more speed would not have created a problem.
 - Deck markings were adequate.
 - The aircraft had good communications with the vessel at all times.
 - Night air operations seemed feasible. The vessel only requires the addition of blue deck lights.

HSV Operational Performance

- JHSV entered the boat basin backward because of the better visibility from the bridge. Moving the bridge forward would decrease this requirement.
- More cameras are needed to cover flight deck blind spots.
- Location of antenna domes creates deck obstructions for helicopters during departure from the vessel.
- JHSV flight deck non-skid is peeling. Need to apply thicker coatings.

Operational Mission Support

- *Joint Venture* successfully conducted a combat reinforcement into Del Mar Boat Basin. The vessel was able to enter the narrow channel and deliver additional LAVs and CSS support for the landing force.
- *Joint Venture* successfully performed a non-combatant evacuation from the Del Mar Boat Basin.
- JHSV could use a ramp fendering system to reduce the chance of metal-to-metal in austere ports. This could reduce the time in port during tactical situations.

Command and Control (C2)

- During their insertion on 28 July, the JHSV acted as a communication relay between Marine Reconnaissance and USS Boxer using the *Joint Venture's* PRC-117F radio and ICS-2003 Matrix Plus radio monitoring system.

Joint Force Interoperability

- The JHSV conducted both SEAL SDV operations and the Marine Reconnaissance insertion on the night of 28 July.

Human Factors & Safety

- Nothing to report.

HSV supportability in extreme environments

- Operated in the narrow confines of the channel to Del Mar Boat Basin.
- To increase the vessel's ability to operate in shallow waters, make sure water injectors for engine propulsion and cooling water are protected to reduce the likelihood of fouling.

HSV survivability in extreme environments

- Nothing to report.

Appendix A: Del Mar Boat Basin

Camp Pendleton's Del Mar Boat Basin was used by *Joint Venture* in its combat reinforcement and subsequent NEO exercise in support of the Ship-to-Objective Maneuver portion of MC 02. Because a pier does not exist in the boat basin, Amphibious Construction Battalion One (ACB-1) constructed one to simulate an "austere port facility."

Del Mar Boat Basin

The Oceanside Harbor/Camp Pendleton Harbor complex is located north of the city of Oceanside and just south of Camp Pendleton Marine Corps Base. The harbor's breakwater and south jetty form an entrance channel. The entrance channel splits to form the Oceanside Channel, which leads to Oceanside Harbor, and the Del Mar Channel, which leads to Camp Pendleton's Del Mar Boat Basin. Historic maintenance dredging has been performed to maintain the navigability of the harbor and to provide material for beach replenishment. Core, diver, and dredge discharge samples taken from the harbor in previous years indicate that the dredged material consist of predominately fine-grained, medium dense sand. Figure A-1 is an overhead image of the area. Figure A-2 is a schematic of the harbor and boat basin area. Circles depict the general location where the pier was constructed.

Del Mar Boat Basin provides a safe anchorage for Marine small boat and AAV operations. It is home to the Third Assault Amphibian Battalion and the Assault Amphibian School. It is also used as a LCU embarkation/debarkation point for transport between the beach and amphibious ships offshore.



Figure A-1. Overhead image of Del Mar Boat Basin/Oceanside Harbor



Figure A-2. Schematic of the Del Mar Boat Basin/Oceanside Harbor area.

Floating Pier

ACB-1 constructed a floating pier in Del Mar Boat Basin for *Joint Venture's* use during MC 02. It consisted of nine causeway sections, non-powered (CSNP) and one causeway section, non-powered (Beach end) (CSNP-BE). Figure A-3 is a view of the floating pier from *Joint Venture*. Figure A-4 is a view of the floating pier from the shore.

Two Side Loadable Warping Tugs (SLWTs) were used to emplace the causeway sections. Military Sealift Command contracted two tugs to transport the CSNPs from their base in Coronado, CA to the Del Mar Boat Basin. This required two separate trips.



Figure A-3. *Joint Venture* view of floating pier.



Figure A-4. Floating pier view from shore.

A vertical fendering, or “rub-rail” systems, were created and attached to two of the CSNPs. Figure A-5 shows one of the units. Horizontal fendering was emplaced at water level on three CSNPs. The purpose of the fendering, both vertical and horizontal, was to limit damage caused by the marriage of the aluminum-hulled *Joint Venture* to the steeled-hulled causeway sections. Plywood sheathing was used as dunnage and emplaced at the point of impact between the *Joint Venture*’s starboard aft quartering ramp and the causeway sections. A graphic depiction of this arrangement is contained in figure A-6.



Figure A-5. Fender constructed for *Joint Venture* interface with CSNP.

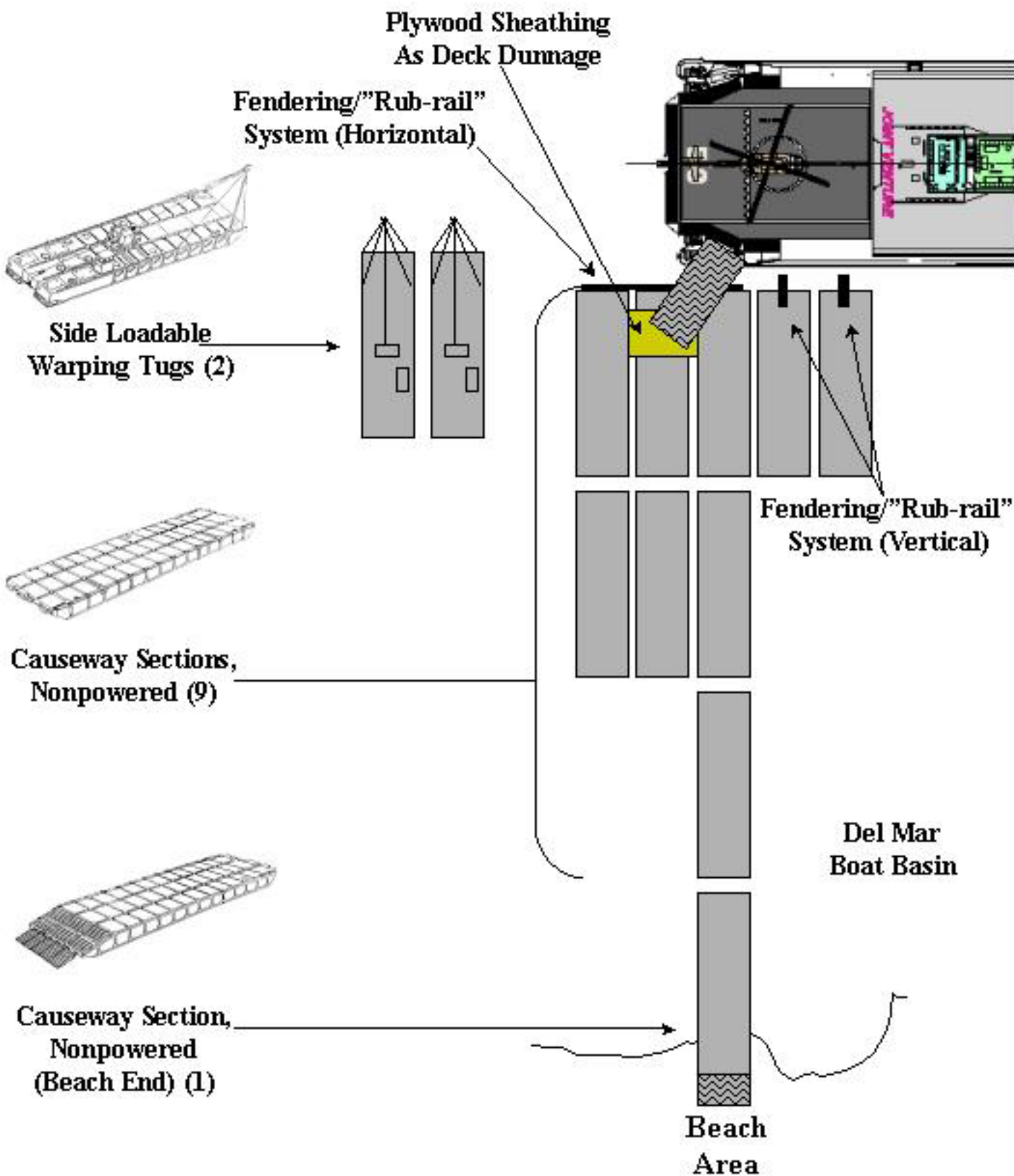


Figure A-6. graphic depiction of the causeway pier